3.0 BASELINE CONDITIONS

3.1 AQUATIC, WETLAND AND RIPARIAN HABITATS

The undeveloped areas within the Watershed support both upland and aquatic habitats. The undeveloped areas generally exist along the north and northeastern mountainous zone and southern coastal foothill zone. The aquatic habitat types found in the undeveloped areas can be classified into one of four different major habitat classifications: marsh; riparian; lakes/reservoirs; and unvegetated watercourses. Of these major habitat types, riparian areas are the most dominant in terms of coverage. These areas are typically along streams and water bodies in the foothill areas. Riparian coverage is estimated at approximately 1,122 acres or one percent of the entire Watershed. The larger water bodies including lakes and reservoirs comprise less than one percent of the Watershed and are generally located in the northern and southern foothill areas.

Common riparian habitats include willow forests and mulefat scrub, along with freshwater marshes in channels containing perennialized (year-round) flow. Several plant and wildlife species listed as endangered and/or threatened occur within riparian habitats and in adjacent upland habitats. These riparian areas support species such as the least Bell’s vireo, southwestern willow flycatcher, and the upland areas include species such as the coastal California gnatcatcher.

Use of the terms “riparian” and “wetland” may lead to confusion unless explicitly defined. Within this EIS/EIR, the following definitions apply (as included in Section 13.0, Acronyms, Abbreviations and Glossary):

Aquatic

General reference to various water-oriented habitats such as rivers, streams, creeks, ponds, lakes, etc. These resources may be perennial, intermittent, or ephemeral in nature.

Waters of the U.S.

Refers to federally regulated rivers, creeks, streams and lakes, bordered by an ordinary high water mark, and extending to the headwaters. Also, includes adjacent wetlands (See 33 CFR 328.3(b); 40 CFR 230.3(s)). Waters of the U.S. are regulated by the Corps 531 U.S. 159 (SWANCC, 2001). The Court found that the Corps could not rely on the presence of migratory birds to find a federal connection to an otherwise isolated, non-navigable water, and therefore, limited the Corps jurisdiction over non-navigable, isolated waters.

Waters of the State

Consistent with the Porter-Cologne Water Quality Control Act, “waters of the state” means any surface water or groundwater within the boundaries of the State of California, including saline waters and perennial, intermittent, and ephemeral rivers and streams (See Water Code section 13050(e)).

Wetland

Refers to the federal definition, and requires three parameters to be present: hydrologic indicators, hydric soil, and hydrophytic vegetation. Wetlands are a subset of waters of the U.S. Wetlands in a riparian context are regulated by both the Corps and the Department.

Special Aquatic Site

Special Aquatic Sites are rare and/or unique habitats inclusive of wetlands, mudflats, pool and riffle areas, vegetated shallows, sanctuaries/refuges, etc., as defined in 40 CFR 230.40-45. With regard to the Watershed, only wetlands (e.g., no mudflats) are present, and are subsequently referred to as Corps-jurisdictional wetlands in the remainder of this document. For the Corps impact analysis and compliance with the 404(b)(1) Guidelines, the term “wetland” is used and the regulatory term Special Aquatic Site is thus inferred. Special Aquatic Sites would be considered a sub-set of waters of the U.S., and a sub-set of the riparian habitat jurisdictional to the Department. Special Aquatic Sites would not be inclusive of non-wetland waters of the U.S.

Riparian

Term used for areas within and adjacent to rivers, streams, and creeks. These areas typically support plant species adapted to (or can tolerate) occasional or permanent flooding and/or saturated soils.

Streambeds

Streambed or stream bed - For the SAMP, the term "streambed" refers to riverine aquatic resources located within the bed, bank, and channel geomorphic features. A streambed may include all or a portion of the riparian zone. Streambeds are a sub-set of aquatic resources, and may overlap with Corps jurisdiction located within the OHWM. Streambed resources include perennial, intermittent, and ephemeral drainages that display a bed, bank, and channel. The Corps regulatory definition of "stream bed" is in terms of its jurisdiction: the substrate of the stream channel between the ordinary high water marks, where the substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed. The Department defines "streambed" as the land beneath a stream and its outermost banks, whereby the streambed includes that portion of a stream channel directly beneath its waters and extends laterally beneath the banks where subsurface hydrologic connectivity exists between the stream and the surrounding land.

Riparian Habitat

Refers to habitat found in a riparian setting, and includes areas within the jurisdiction of both the Corps and the Department. Riparian habitat would contain the applicable river, stream, or creek (within an ordinary high water mark for Corps jurisdiction). Riparian habitat may contain three-parameter wetlands (federal definition), but usually does not. This term refers to streamside habitat that is under jurisdiction of the Department.

Riparian Ecosystem

An ecosystem defined by linear corridors of variable width occurring along rivers, streams, and creeks. Hydrologic interaction (with a river, stream, or creek) and distinct geomorphic features are two unique components of this ecosystem.

3.1.1 Planning Level Delineation of Riparian Ecosystems

The SAMP/MSAA planning process began with a comprehensive analysis of existing conditions within the Watershed. As part of the identification and characterization of existing aquatic resources in the Watershed, the Corps performed two key studies: Planning Level Delineation (PLD) and Landscape Level Functional Assessment (LLFA). These studies are also discussed in the context of the SAMP Analytical Framework in Section 2. The PLD is discussed below, and the LLFA is discussed in the following section (Section 3.1.2).

The Corps (Lichvar et al. 2000) conducted the PLD of aquatic resources within the Watershed, including riparian habitats, wetlands, and non-vegetated streams within the jurisdictions of both the Corps and the Department. Aquatic resources were identified using a high precision PLD approach that adjusts the sampling methods outlined in the Corps Wetlands Delineation Manual (Environmental Laboratory, 1987) and 33 CFR 328 and applies them at a watershed scale. This delineation approach allowed for the identification of different types of waters of the U.S. and State over a large area (watershed scale). While the approach provides a high quality map of jurisdictional wetlands and waters of the U.S., suitable for use in project planning, it does not serve as a substitute for the on-site jurisdictional delineation that is normally conducted as part of Section 404 permit and Streambed Alteration Agreement review process. Details of the PLD methodology are included in Appendix B-1.

In the PLD, Lichvar et al. (2000) evaluated the existing vegetation spatial databases (maps) supplied by the County of Orange (County). Lichvar et al. (2000), though, did not utilize these maps because of the following limitations: 1) numerous rectification problems, 2) lacked sufficient detail to produce acceptable wetland maps, and 3) the spatial extent of the map units was too large to be used for the SAMP/MSAA. In order to develop the wetland delineation map units, Lichvar et al. (2000) developed a new spatial database for use in this project (see the PLD in Appendix B-1 for more details).

Based on the PLD, aquatic resources (inclusive of waters of the U.S. and streambeds) within the Watershed totaled 2,266 acres. There were 354 miles of ephemeral and intermittent stream channels identified as waters of the U.S. These areas were mostly first and second order streams and located higher in the Watershed. Table 3-1 is a summary of the main aquatic resource types found in the Watershed. Figures 3-1a and 3-1b show the results of the PLD for the northern and southern portions of the Watershed, respectively.

Table 3-1. Aquatic Resource Types Identified by Lichvar et al. (2000)

Aquatic Resource Type Designations	Total Acres within Watershed
Ephemeral Drainages and Washes	51.8
Intermittent Streams and Creeks	20.9
Perennial Rivers and Streams	213.2
Flood Control Channels	191.5
Spreading Grounds and Detention Basins	107.8

The first order streams were digitized by stereoscoping the locations on the aerial photographs and then digitizing the coverage by using the rectified orthophoto quadrangle as a background. The first order streams, identified on the coverages as lines (referred to as 'waters of the U.S.1'), were 15 feet or less wide. These single line features were not associated with other hydrogeomorphic surfaces. In several instances, second and third order streams were also identified as a single line due to their narrow width and lack of other hydrogeomorphic surfaces. Typically, these single-lined second and third order stream channels resulted from human influences that caused down cutting in the channel. Larger intermittent and/or perennial streams were identified on the coverages as polygons (referred to as waters of the U.S.).

Thirty-one vegetation (riparian and some upland) and aquatic resource categories were identified by Lichvar et al. (2000). Fifteen categories accounted for riparian vegetation communities within the study area. The identification of these categories began by using vegetation coverages obtained from Orange County. Additional information about species typically found in these community designations may be found in Lichvar et al. (2000), Corps (2001), and JSA (1993).

Below are summaries of aquatic resources types and riparian vegetation communities as delineated by the PLD protocol. Descriptions are from Lichvar et al. (2000) unless noted otherwise. Table 3-2 shows the relative amounts of riparian habitat mapped within the Watershed.

Aquatic Resource Types mapped within the Watershed

Ephemeral Drainages and Washes. These drainages flow during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. (Federal Register, Vol. 67, No. 10; 2002). They are delineated solely by hydrologic indicators such as the presence of an Ordinary High Water Mark. These drainage features usually provide biogeochemical types of functions. In the PLD, these drainages were typically less than 15 feet wide and were mapped as line features.

Intermittent Streams and Creeks. Intermittent streams and creeks include watercourses such a flood control channels, culverts, streams and rivers that temporarily contain water during rain events and shortly thereafter. Portions of intermittent streams and creeks can be vegetated with plants found in the herbaceous riparian vegetation type and/or the willow riparian scrub, woodland or forest vegetation types. These drainage features may provide functions such as nutrient cycling, groundwater recharge, and habitat support. In the PLD, these drainages were typically greater than 15 feet wide and were mapped as polygon features (vegetated or non-vegetated).

Perennial Rivers and Streams. Perennial rivers and streams include watercourses such as flood control channels, streams, and rivers that contain water year-round. Portions of perennial rivers and streams can be vegetated with plants found in the herbaceous riparian vegetation type and/or the willow riparian scrub, woodland or forest vegetation types. Within the Watershed, most perennial streams result from dry-season runoff from residential areas.

Flood Control Channels. Flood control channels consist of concrete-lined and soft-bottomed watercourses designed to convey large volumes of water during rain events. Flood control channels are generally unvegetated but vary greatly and may support herbaceous riparian, willow riparian scrub and Mule Fat Scrub vegetation types. Many of these channels are routinely maintained by the County (or private landowners), and usually do not contain substantial vegetation growth.

Spreading Grounds and Detention Basins. Basins for detention and groundwater replenishment (spreading basins) consist of enclosed water bodies such as detention/evaporation basins and small ponds. Basins often contain vegetation found in the herbaceous riparian and/or ruderal vegetation types. Within the Watershed, these facilities are routinely maintained (by both mechanical and chemical means) for sediment and vegetation control. Thus, vegetation does not establish within these areas to any great extent. If left undisturbed, or in designated no-maintenance areas within particular basins, riparian vegetation has the potential to develop into dense thickets.

Figure 3-1a. Results of the Planning Level Delineation, Northern portion of the Watershed

Figure 3-1b. Results of the Planning Level Delineation, Southern Portion of the Watershed

Riparian Vegetation Communities mapped within the Watershed

Southern Coastal Salt Marsh. [SCSM] Salt marsh consists of halophytic perennial herbs and low shrubs that occur on regularly (or historically) flooded or saturated clay and silt solids that are high in salts. Salt marsh is dominated by California cord grass *(Spartina foliosa)* in low intertidal areas, pickleweed *(Salicornia virginica)*, coastal salt grass *(Distichlis spicata)*, shoregrass *(Monanthochloe littoralis)*, fleshy jaumea *(Jaumea carnosa)*, American saltwort *(Batis maritima)*, alkali heath *(Frankenia salina)*, California marsh rosemary *(Limonium californicum)*, saltbush (*Atriplex* sp.), and sea-blite *(Suaeda* spp.*)*.

Coastal Freshwater Marsh. [FWS] Freshwater marsh consists of seasonally or permanently flooded low-lying areas dominated by cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.), along with species such as marsh fleabane (*Pluchea odorata*), swamp water weed (*Polygonum lapathifolium*), mayweed (*Cotula coronopifolia*), willow herb (*Epilobium* spp.), Spanish sunflower (*Pulicaria paludosa*), seep monkeyflower (*Mimulus guttatus*), and speedwell (*Veronica* spp.).

Riparian Herb. [RH] Herbaceous riparian vegetation is an early successional stage of riparian scrub and forest. Flooding (or other disturbance factors) often scours woody riparian vegetation away and the site is rapidly colonized by pioneer wetland herbaceous plants and other weedy species. Examples are mugwort (*Artemesia douglasiana*), cattails, sedges, willow seedlings and saplings, millet ricegrass (*Piptatherum meliacea*), rabbit-foot grass (*Polypogon monspeliensis*), cocklebur (*Xanthium strumarium*), western ragweed (*Ambrosia psilostachya*), and black mustard (*Brassica nigra*). Various grasses may also be found within this habitat type.

Floodplain Sage Scrub. [FSS] This vegetation type occurs in alluvial washes and floodplains where flooding is infrequent. Dominant species include Scalebroom (*Lepidospartum squamatum),* California sage (*Artemisia californica*), buckwheat (*Eriogonum fasciculatum*), and various introduced grasses.

Mule Fat Scrub. [MFS] Mule fat (*Baccharis salicifolia*) scrub consists of dense stands of mule fat with lower concentrations of willow. This vegetation type is commonly found within intermittent streambeds, washes and seeps. Other species associated with this vegetation type often include mugwort, western ragweed, castor bean (*Ricinus communis*), cocklebur, rabbit-foot grass, bermuda grass (*Cynodon dactylon*), and Brome (*Bromus* sp.).

Southern Willow Scrub. [SWS] Willow species and riparian forest saplings dominate willow riparian scrub. This vegetation type is characterized by arroyo willow (*Salix laseolepis*) and red willow (*Salix laevigata*) with lower concentrations of mule fat and/or black willow.

Sandbar Willow Scrub. [SEWS] This vegetation type is dominated by Coyote Willow and Sandbar Willow (*Salix exigua)* in shrub and herb layers. This willow species is adapted to areas with repeated natural disturbances, such as in flood scour zones.

Southern Arroyo Willow Forest. [SAWF] This vegetation type is dominated by an arroyo willow canopy, with other components being other willow species such as black willow. This type is found throughout the Watershed, including Sand Canyon, Serrano Creek, Agua Chinon, Upper Borrego Canyon, Shady Canyon, and Bommer Canyon.

Black Willow Riparian Forest. [BWRF] Black willow riparian forest is a multilayered forest with a canopy dominated by mature black willow (*Salix goodingii*) with some lower concentrations of arroyo willow and red willow, and coast live oak (*Quercus agrifolia*) and sycamore (*Platanus racemosa*) occasionally present on the outer margins. This vegetation type is found on floodplains along major streams and creeks, including Peters Canyon, San Diego Creek Channel, and San Joaquin Marsh.

Cottonwood-Willow Riparian Forest. [CWRF] Cottonwood-willow riparian forest (southern cottonwood-willow riparian forest) is a multilayered forest community dominated by Fremont cottonwood (*Populus fremontii* ssp. *fremontii*), black cottonwood (*Populus balsamifera* spp. *trichocarpa*), black willow, and red willow. A second canopy layer consisting of arroyo willow, mule fat, poison oak (*Toxicodendron diversilobum*), wild grape (*Vitis girdiana*) is often present. Various herbs and vines may comprise the understory. Several invasive weedy species are found in this vegetation type, including giant reed (*Arundo donax*), castor bean, and tree tobacco (*Nicotiana glauca*).

Southern Sycamore Riparian Woodland. [SSRW] Sycamore riparian woodland consists of open to dense woodlands dominated by western sycamore, with coast live oak and Mule Fat Scrub, or willow riparian scrub as an understory. Other species associated with this vegetation type include holly-leaf redberry (*Rhamnus ilicifolia*), California coffee-berry (*Rhamnus californica*), laurel sumac (*Malosma laurina*), Mexican elderberry (*Sambucus mexicana*), fuchsia-flowered gooseberry (*Ribes speciosum),* toyon *(Heteromeles arbutifolia*), poison oak, and lemonadeberry (*Rhus integrifolia*). Large grassland areas dominated by *Bromus* sp. are often present under and between the canopies of the trees in this vegetation type. Sycamore riparian woodland is often found on large intermittent streams throughout the Watershed, including Serrano Creek, Agua Chinon, Upper Borrego Canyon, Bommer Canyon, and Shady Canyon.

Southern Coast Live Oak Riparian Forest. [SCLORF] This vegetation type occurs around intermittent and ephemeral drainages throughout the Watershed. Dominated by coast live oak, the understory may contain various riparian and/or upland plant species. Often, this vegetation type is intergraded with sycamore riparian and coast live oak woodlands.

Coast Live Oak Woodland. [CLOW] This community type is dominated by coast live oak with associated shrubs such as California coffee-berry, toyon, *Ribes* spp., elderberry, and poison oak. The herb layer may various herbs and grasses. This vegetation type is generally located on north-facing slopes and shaded ravines, not necessarily associated with drainages.

Canyon Live Oak Ravine Forest. [CLORAVF] This vegetation type is a montane riparian community of steep headwaters dominated by various *Quercus* sp., and may include such tree species as maple (*Acer macrophyllum*) and California bay (*Umbellularia californica*). This community is not common, as it is only found within a few locations in the mountainous region (see Zone 1 below) of the Watershed.

Table 3-2. Riparian Habitats as Identified by the PLD (Lichvar et al. 2000)

Riparian Habitat Type Designations	Total Acres within Watershed 1	7	Total (sum of rating 1-7)
Southern Coastal Salt Marsh	0.2	0?	0.2
Coastal Freshwater Marsh	259.2	45.5	304.7
Freshwater Seeps, Swales	0.8, 0.1	0?	0.8, 0.1
Riparian Herb	37.2	4.3	98.4
Floodplain Sage Scrub	0	0	1.6
Mulefat Scrub	44.0	25.4	113.2
Southern Willow Scrub	63.3	4.4	129.7
Sandbar Willow Scrub	1.4	2.1	3.5
Southern Arroyo Willow Forest	54.9	23.6	101.9
Southern Black Willow Forest	25.7	52.8	139.4
Southern Cotttonwood-Willow Riparian Forest	0	10.7	10.7
Southern Sycamore Riparian Woodland	0.6	5.9	66.2
Southern Coast Live Oak Riparian Forest	10.2	0.7	121.1
Coast Live Oak Woodland	0.3	0	254.4
Canyon Live Oak Ravine Forest	0	0.5	0.5

[1] Acres for Ratings 1 – 3 refer to features most likely to be Corps jurisdictional, and acres for Rating 7 refer to mitigation sites (resulting from past Corps permit actions and therefore jurisdictional). Ratings refer to the likelihood that a riparian vegetation polygon is Corps jurisdictional. Rating 1 = 100%, Rating 2 = 67-98%, Rating 3 = 33-66%, Rating 4 = 2-32%, Rating 5 = < 2%, Rating 6 = Unregulated Uplands. The total acres column is approximately equivalent to the Department jurisdiction (Ratings 1 – 5 are the Department jurisdictional). Only ratings 1, 7, the overall total are shown; ratings 1 and 7 do not equal the total in this table.

Table 3-3. Major Vegetation Distribution Patterns by Zones

Zones	Major Landform	Aquatic Resource Types[1]
Zone 1	Mountainous	SCLORF, Intermittent Channels, and SWS; most areas first and second order streams with poor development of flood plain terraces.
Zone 2	Coastal Foothills	SAWF, intermittent channels, SBWF, SSRW, SWS; development of some floodplain terraces; mixed active floodplains with flood plain terraces.
Zone 3	Central Flats	FWM, RH, SWS, perennial rivers and streams; highly modified for agriculture and urban development purposes.

Source: Lichvar et al. (2000). (Map of topographic zones is provided in Section 3.2.1).
[1] For acronym explanations, see above paragraphs in this section

Distribution of Riparian Vegetation Communities

According to Lichvar et al. (2000), several distribution patterns of the riparian vegetation types were observed within the three major topographic relief zones within the Watershed. Riparian vegetation distribution patterns within the Watershed are driven by two major features: land development and major topographic features as indicted in Table 3-3.

Riparian vegetation units in Zone 1 (mountainous) reaches of the Watershed are less impacted from land development than those in lower reaches. In the higher elevations of the Watersheds the riparian vegetation types are associated with rocky to gravelly channel substrates. Upland chaparral vegetation types are common in these reaches since the ephemeral and intermittent stream channel areas are dry most of the time. Most of these vegetation types are dominated by upland species except for Southern Willow Scrub, which contains hydrophytic species (i.e., plants adapted to flooding conditions).

In contrast, the lower elevations of the Watershed in both Zones 2 and 3 where there is an increase in hydrology, flood plain terraces, and culturally influenced hydrology regimes, the number of vegetation types increase. Flood Control Channels and Southern Arroyo Willow riparian forest are located in areas below discharge points (from urban areas) for storm water in association of agricultural field and urban development. Generally, most of the larger and wetter wetland areas are located in the lower parts of the Watershed where human influences are prevalent. Sub-Watersheds such as Borrego, Sand Canyon, and portions of San Diego Creek have frequent occurrences of these wetland vegetation types. Plant species compositions in these types are mostly wetland plants except those associated with the riparian herb type. The fresh water marsh type is dominated by man-made features. Most of these wetland types have occurrences of tule (*Scirpus californicus*), cattail (*Typha latifolia*), and spike rush (*Eleocharis macrostachya*). Each of these species is an indicator of disturbances and reflects the altered wetland conditions they are located in. Most of the features associated with this type are settling ponds, abandoned barrow pits, and margins of man made reservoirs located throughout the Watershed.

The sycamore woodlands that are located in parts of Zones 2 and 3 are located in dry upland terraces with very little wetland features. The conversions of sycamore woodlands to pastures are common here. In most of the Watershed, one of the several types of willow is the dominant vegetation type found on the terraces. These types are located mostly along the edges of the active flood plain or on the terrace. At some locations the level of introduced species are lower and the site is less disturbed, but overall it appears that the willow communities have been able to either adapt or respond to all the human modification. The most dramatic impact to wetlands and flood plain riparian systems has been the agricultural and human developments that occurred within the Watershed. In Zone 3, most of the historical flood plains and wetlands have been eliminated and replaced with concrete line channels.

Invasive Plant Species within Riparian Habitats

An important detrimental impact to riparian habitat is the presence and expansion of invasive plant species. These plant species are non-native to California and have the potential to displace native species and alter riparian ecosystem functioning. The California Invasive Plant Council (Cal-IPC, 2006) rated invasive species according to their “invasiveness” in California. The overall score (invasiveness category) includes consideration of impacts, invasiveness, and distribution within California:

- High- invasive plants with severe ecological impacts on physical processes, plant communities and habitat structure; these plants have moderate to high rates of dispersal and establishment;
- Moderate- invasive plants with substantial, but not severe, ecological impacts;
- Limited- invasive plants with minor ecological impacts on a state-wide level; or, there is insufficient data to categorize them as High or Moderate.

Various invasive plant species occur within the riparian habitat of the Watershed, including (with Cal-IPC list rating): saltcedar (*Tamarix* spp.; High), pampas grass (*Cortaderia* sp.; High), arundo (*Arundo donax*; High), black mustard (*Brassica nigra*; Moderate), eucalyptus (*Eucalyptus* spp.; Moderate), tree-of-heaven (*Ailanthus altissima*; Moderate), castor bean (*Ricinus communis*; Limited), poison hemlock (*Conium maculatum*; Moderate), and Brazilian pepper (*Schinus teribinthifolius*; Limited).

Arundo is one of the most common and widely distributed species within riparian habitat within the Watershed. A survey of *Arundo donax* in the Watershed drainages was conducted in 2001 (Harmsworth, 2002), and found approximately 6.0 acres. These acreages have increased slightly since then. The purpose of the study was to provide supplementary information for the SAMP/MSAA process, particularly with regard to the restoration element discussed later in this section.

3.1.2 Landscape Level Functional Assessment

The Corps (Smith, 2000) conducted an assessment of the riparian ecosystems of the Watershed (Appendix B-2). The overall objective of the assessment was to characterize and rank the “integrity” of the riparian ecosystems in order to provide the basis for evaluating the impacts of various SAMP/MSAA alternatives on riparian ecosystems. The assessment was accomplished by dividing the riparian ecosystem along the project site drainages into assessment units or “riparian reaches” and assessing each riparian reach using a suite of indicators of ecosystem integrity.

Riparian ecosystems consist of the biological, physical, and hydrologic features that occur along perennial, intermittent, and ephemeral drainages of project site. The center of the ecosystem consists of the stream channel. The hydrologic interaction between the stream channel and the adjacent areas typically results in two distinct zones. The first zone is called the active floodplain. It includes areas that are inundated by overbank flooding, which typically occurs at least once every five years. This zone exhibits the fluvial features associated with recurring flooding such as point bars, areas of scour, sediment accumulation, and debris. The second zone consists of less frequent floodplains and terraces formed by infrequent fluvial processes. Vegetation in the stream channel consists of aquatic species and short-lived herbaceous plants that are adapted to continual disturbances by scouring. Vegetation in the two floodplain zones is composed of woody perennials that rely on the high water tables present in the riparian zone and capable of re-establishment after floods. A profile of a typical riparian ecosystem is provided on Figure 3-2.

Figure 3-2. Cross-Sectional Profile of a Representative Riparian Ecosystem

"Waters of the U.S." consist of drainages and wetlands subject to regulation under Section 404 of the CWA. Within riparian ecosystems, "waters" include: (1) perennial, intermittent, ephemeral stream channels exhibiting a distinctive bed and bank; and (2) wetland vegetation in the floodplain zones that meet the hydrologic, hydrophytic vegetation, and hydric soils criteria outlined in the Corps Wetlands Delineation Manual (Corps 1987). Not all vegetation in the floodplain zones meets these criteria and represents jurisdictional "waters." In contrast, riparian ecosystems (including both floodplain zones) typically encompass the area of jurisdiction under FGC Section 1600 *et seq.* generally defined as streams, rivers, and creeks that provide habitat for fish and wildlife.

Smith (2000) defined riparian ecosystems with high ecosystem "integrity" as riparian areas that: (1) exhibit the full range of physical, chemical, and biological attributes and processes that characterized riparian ecosystems in the southern California region over short- and long-term cycles prior to cultural alteration; and (2) support a balanced, integrated, and adaptive biological community resulting from natural evolutionary and biogeographic processes. The concept of ecosystem integrity involves many characteristics and processes, and consequently there is no single, direct measure of ecosystem integrity. In order to focus on the most important characteristics and processes contributing to ecosystem integrity, the Corps (2001) identified three ecosystem attributes to represent ecosystem integrity: hydrologic, water quality, and habitat integrity. The selection of these attributes follows directly from the mandate in Section 101(a) of the CWA to "*…restore and maintain the chemical, physical, and biological integrity of the Nation's waters*."

To assess riparian ecosystem integrity, the Corps defined a standard of comparison or "reference condition." It represents a conceptual condition under which riparian ecosystems achieve and sustain a high level of integrity. For the assessment, Smith (2000) defined the reference condition as the "culturally unaltered condition," which consists of the conditions in riparian ecosystems at the project site that existed prior to grazing, agriculture, fire suppression, water resource management, transportation corridors, urbanization, and other cultural alterations.

"Culturally unaltered" was selected as the reference condition for the assessment because it represents the physical, chemical, and biological conditions under which riparian ecosystems have naturally evolved, and therefore, presumably represents the physical, chemical, and biological conditions that the CWA mandates should be maintained. Culturally unaltered reference conditions are expected to be uncommon in the Watershed due to the various urban and agricultural disturbances in the Watershed since Spanish colonization. However, Smith (2000) states that it is possible to make reasonable speculations as to what culturally unaltered conditions were like based on examples of apparently unaltered riparian ecosystems in other portions of southern California.

3.1.3 Habitat Integrity

To assess the three ecosystem integrity attributes (i.e., hydrologic, water quality, and habitat), Smith (2000) developed "indicators," which represent indirect measures of the attributes that can be readily measured through field, map, and aerial photograph investigations. A summary of habitat integrity attributes and the indicators used to evaluate habitat integrity in the Watershed is provided below.

Riparian ecosystems with habitat integrity exhibit the quality and quantity of habitat necessary to support and maintain a balanced, integrated, adaptive biological system having the full range of characteristics, processes, and organisms that historically characterized riparian ecosystems in the region. Several factors were considered in selecting indicators of habitat integrity including the spatial extent and quality of riparian habitat, the "connectedness" of riparian habitats at the riparian reach and drainage basin scales, and the spatial extent and quality of upland habitat in the landscape adjacent to riparian ecosystems. The key indicators of habitat integrity included:

- **Area of Native Riparian Vegetation** – a measure of the degree to which native riparian vegetation occur the floodplain;
- **Riparian Corridor Continuity** – a measure of the extent of continuous, uninterrupted riparian vegetation along the drainage;
- **Land Use/Land Cover: Riparian Ecosystem Boundary** – a measure of the presence of man-made features at the boundary of riparian ecosystems and uplands that would inhibit normal movement of wildlife between riparian and upland habitats; and
- **Land Use/Land Cover: Upland Buffer** – a measure of the degree to which the land uses in the upland areas adjacent to riparian ecosystems have been converted to man-made uses (e.g., urban, agricultural, etc.).

Functional Assessment Process

The assessment of riparian ecosystem integrity was conducted by completing the following sequential tasks (Smith 2000):

Task 1: Identification of riparian reach assessment units;
Task 2: Characterization of riparian reaches;
Task 3: Assessment of indicators;
Task 4: Assigning indicator scores and calculation of indices; and
Task 5: Archiving of information.

The drainages in the Watershed were divided into assessment units called "riparian reaches." A riparian reach was defined as a segment of the stream channel and the adjacent riparian ecosystem exhibiting relatively homogenous characteristics with respect to geology, geomorphology, channel morphology, substrate type, vegetation communities, and cultural alteration. In association with each riparian reach, two other areas were defined including a "local drainage area" and a "drainage basin" (Figure 3-3a and Figure 3-3b). The local drainage area of a riparian reach included the area from which surface water drained directly to the mainstem channel or tributaries that entered the mainstem channel in the riparian reach. The local drainage area did not include areas that drained to the mainstem channel of upstream riparian reaches.

Figure 3a. Illustration of a Riparian Reach and Local Drainage Basin

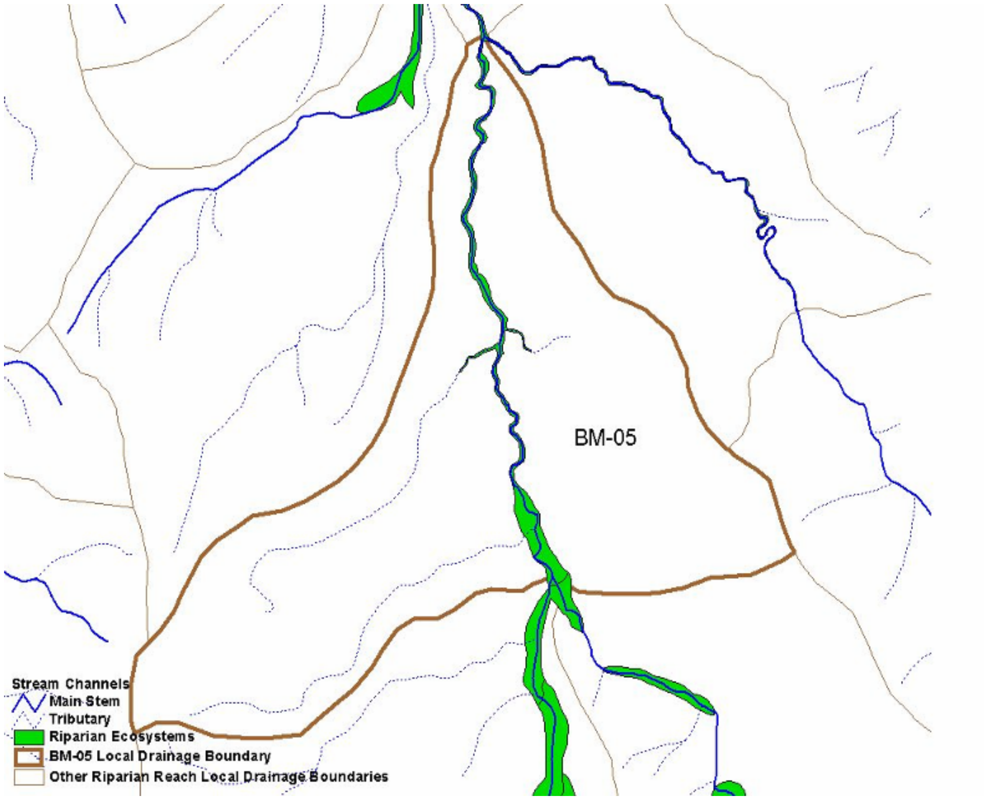


Figure from Smith (2003).

Figure 3b. Illustration of a Drainage Basin

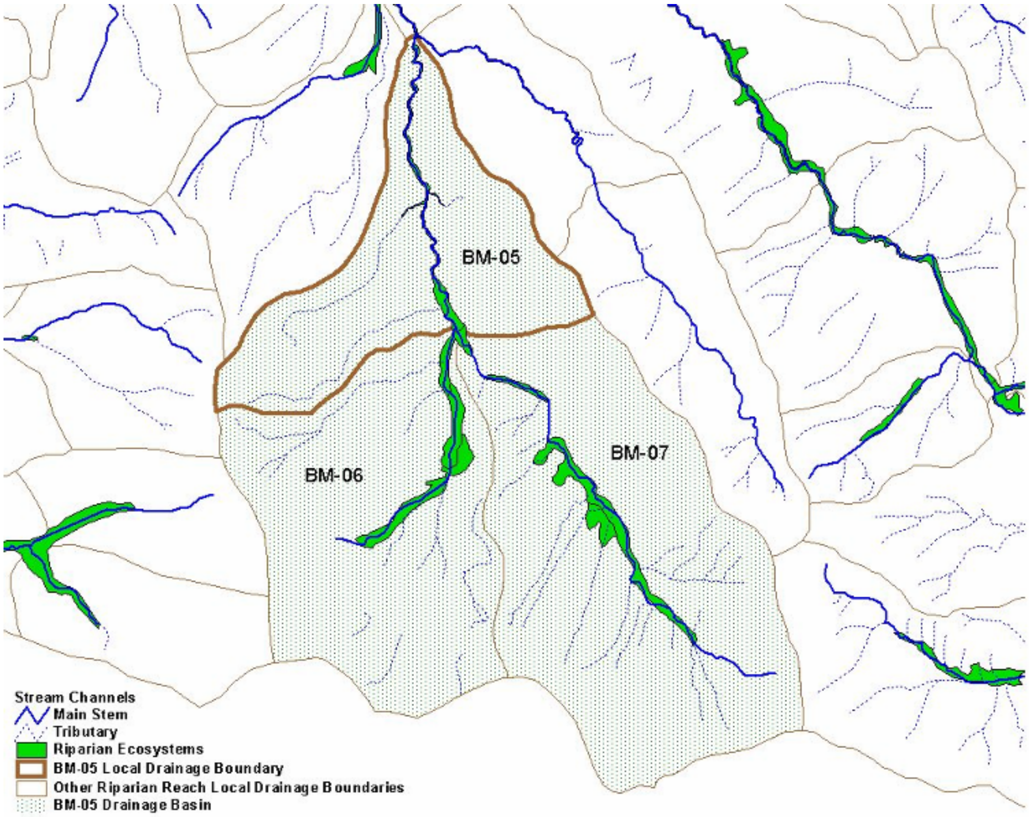


Figure from Smith (2003)

Most riparian reaches were characterized based on field surveys. Inaccessible reaches were characterized through the use of aerial photographs and topographic maps. Ecosystem integrity indicators were measured using a combination of fieldwork and spatial analysis in a Geographic Information System (GIS). Indicator values were assigned as a percent deviation from the reference condition (i.e., 0 to 100 percent). The range of indicator values was then divided into five categories and assigned an indicator score of 1-5 to simplify the calculation of endpoint indices, and facilitate presentation of results in tables, charts, and GIS. A score of 5 represents close concurrence with the reference condition, and consequently a high level of integrity. A score of 1 represents a deviation of 50 percent or more the reference condition, and consequently a low level of integrity.

Overall hydrologic, water quality, and habitat integrity indices were calculated in the spreadsheet by summing the scores of the indicators associated with hydrologic, water quality, and habitat integrity as discussed above. Individual indicator scores and summary indices were presented in tabular form in the spreadsheet and spatially in GIS. Scores and indices were presented for individual riparian reaches, as well as for entire drainages.

Functional Assessment Results

Smith (2000) identified 186 riparian reaches in the Watershed with drainage basins averaging 3,175 acres. In general, the index values exhibited a relatively wide and even spread across the possible range of index values suggesting that indicators were scaled appropriately and were sensitive enough to distinguish varying degrees of hydrologic, water quality, and habitat integrity. A summary of the ecosystem integrity scores for the three key ecosystem attributes for all drainages in the Watershed is presented in Table 3-5.

Table 3-5. Summary of Ecosystem Integrity Scores – All Drainages Combined

Ecosystem Integrity Attribute	Mean Score	Range	Maximum Possible Score
Hydrologic	18	6-29	30
Water Quality	28	13-42	45
Habitat	12	5-25	30

The spatial distribution of ecosystem integrity scores for habitat is shown in Figure 3-4. The spatial distribution scores for hydrologic integrity and water quality integrity are provided in Section 3.3.3 Hydrology, Erosion, and Sedimentation and Section 3.4.8 Water Quality, respectively.

Figure 3-4 shows the indicator scores for each riparian reach. Dark areas represent scores where the habitat integrity score is high. Lighter areas represent reaches where habitat integrity has been reduced due to anthropogenic disturbances. The lowest habitat integrity scores were observed along creeks where land development has altered the channels and local drainage basins. Some tables in this document refer to reaches with High, Medium and Low integrity. In these cases, the scores are relative scores (or percentage out of 100): High = 0.7 or higher, Medium = 0.4 to 0.7, and Low = less than 0.4.

General types of impairments that reduced the integrity of various riparian reaches were as follows:

- Discontinuity in riparian corridor due to habitat disturbances;
- Increased low-flows due to irrigation return flows and runoff from developed areas;
- Presence of non-native vegetation along certain reaches;
- Presence of adjacent land uses that reduce habitat quality and increase nutrient, pesticide, and sediment loading;
- Disturbances along channel margins that impede wildlife movement to and from uplands; and
- Land use and channel modifications that have disrupted natural sediment dynamics in the Watershed and channel, respectively.

The results of the LLFA allowed for the identification of high and medium quality riparian ecosystems, and represent the cornerstone of the SAMP Analytical Framework (discussed in Section 2.1.1). The LLFA was also used for planning (avoidance and minimization of impacts) of several recent projects within the Watershed. In other contexts, the LLFA may also be used for simulating changes that could be expected to occur as a result of a proposed project (impact analysis), for conducting an alternatives analysis, or for calculating the acreage and functional gain from proposed mitigation or restoration projects.

Figure 3-4. Spatial Distribution of Ecosystem Integrity Scores, Habitat

Changes to the Watershed Baseline After the Year 2000

The Corps collected permit data from its regulatory database (RAMS2, ORM2) to determine the extent of permitted impacts (and compensatory mitigation) that occurred since the preparation of the LLFA (Smith 2000). The permanent impacts and compensatory mitigation acreage data were collected from permits issued between 9/1/2000 through 7/31/2007 (Table 3-6). Acreages related to bank stabilization and temporary impacts were not included in the data, because these projects did not fundamentally change the mapping of the aquatic resources. There were a few projects that were permitted before 9/1/2000, but were not constructed until after the preparation of the LLFA report; such impacts are not captured in the data presented in Table 3-6. However, some of these previously permitted impacts were captured when corrections were made in 2002 to the GIS mapping with the resulting aquatic resources map serving as the basis of the SAMP analysis.

Since the adoption of the final PLD aquatic resources vegetation map in 2002, the amount of impacts that have been permitted is small compared to the total acreage of aquatic resources in the Watershed. Impacts to 52.17 acres of total waters of the U.S. (21.86 acres of wetlands and 30.31 acres of non-wetland waters) represent about 2% of the total aquatic resources within the Watershed. The effects of the permitted activities on the overall conclusions made about the Watershed are minimal.

3.2 Biological Resources Including Threatened and Endangered Species and Migration Corridors

This section describes the existing biological conditions within the Watershed, and includes the following: (1) topographical overview of the Watershed that defines the vegetation types; (2) biological reserves; (3) upland habitats; (4) threatened and endangered species known to occur, or may potentially occur within the Watershed; (5) the status of wildlife migration corridors linking the northern and southern portions of the Watershed; and (6) critical habitat designated by the USFWS.

3.2.1 Topographical Relief and Vegetation Communities

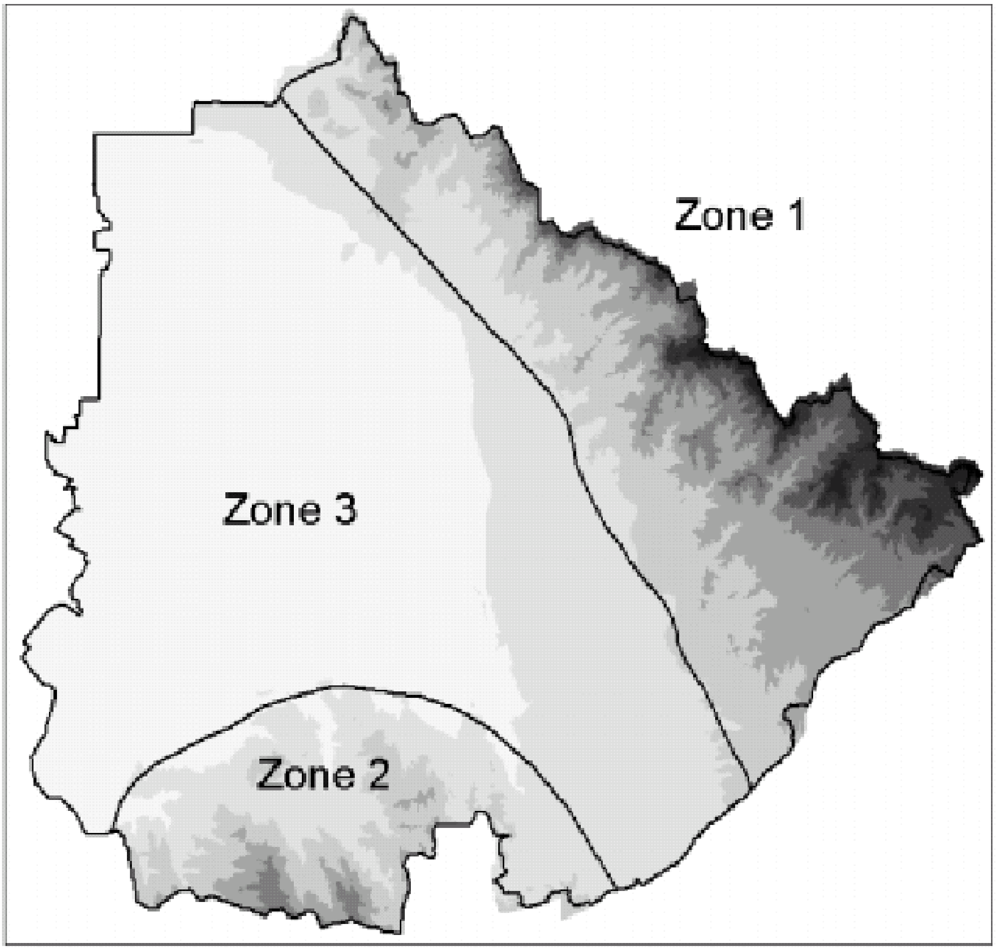
The 154-square-mile Watershed encompasses a wide variety of habitat types generally grouped within three major landforms (topographic relief zones). These include a mountainous zone, the coastal foothills, and the central flats as shown in Figure 3-5. The mountainous zone is comprised of the Santa Ana Mountains and covers the northeastern portion of the Watershed. The coastal foothills, or San Joaquin Hills, are located in the southern portion of the Watershed east of Newport Bay and south of the I-405. The central flats, the largest zone in terms of area, occupies the broad floodplain of San Diego Creek, Peters Canyon Wash, and their tributaries between the mountainous zone and coastal foothills including the areas around Newport Bay and the majority of the northwestern portion of the Watershed.

Table 3-6. Permanent Impacts and Compensatory Mitigation for Wetlands and Non-Wetland Waters of the U.S. Permitted Between 9/1/2000 and 7/31/2007

	Corps Permit Action ID No.	Wetlands		Non-Wetland Waters of U.S.	
		Impact (acres)[U]	Compensatory Mitigation Creation, Restoration, and/or Enhancement (acres)	Impact (acres)[U]	Compensatory Mitigation Creation, Restoration, and/or Enhancement (acres)
Permitted activities reflected in baseline LLFA	970019000	6.5	9.75	2.4	2.4
Permitted activities not reflected in baseline LLFA, but in SAMP	200501057	2.54	5.06	6.11	8.84
	200400594	0	0	1.46	3.1
	200500648	1.02	3.73	1.85	6.05
	200600752	0.25	2.75	1.00	0.75
	200601452	1.66[L]	1.66	3.34[L]	8.61
Permitted activities not reflected in baseline LLFA, and not considered in SAMP	990005600	0.86	0.8	2.12	0.8
	199916339	1.39	2.96	2.77	24.85
	200001036	0.04	3.1	2.47	0
	200100337	0	0.5	0.43	0
	980060000	0.92[M]	2.5	1.66[M]	2.5
	200201165	0.188[M]	0.68	0[M]	0.62
	200201168	0.41[M]	0.79	0.02[M]	0
	200201466	0.73[L]	1.33	0.46[L]	0
	200000361	0.44[L]	0.05	1.0[L]	0
	200201465	0[L]	0.42	0.42[L]	0
	200201473	0	0	0.1[L]	0.1
	200301554	2.28[L]	2.78	0.50[L]	0
	200401759	0	0	0.34[L]	0
	200500058	0.57[L]	5.44	1.67[L]	2.0
	200500678	0	0	0.08[L]	0.18
	200600212	2.06[L]	2.06	0.11[L]	0.75
Total acreage not reflected in baseline LLFA and not in SAMP		21.86	46.36	30.31	61.55
Pending applications – low integrity resources		Acreage unknown - pre-decisional	Acreage unknown - pre-decisional	Acreage unknown-pre-decisional	Acreage unknown - pre-decisional

[U] Denotes undetermined integrity of aquatic resources, unless otherwise indicated.
[M] Denotes moderate to high integrity aquatic resources were permitted for impacts.
[L] Denotes low integrity aquatic resources were permitted for impacts.

Figure 3-5. Topographic Relief Zones of the Watershed



Source: Lichvar et al. (2000). Zone 1 = Mountainous; Zone 2 = Coastal Foothills; Zone 3 = Central Flats.

Zone 1: Zone 1 includes the mountainous region (i.e., Santa Ana Mountains) located in the north eastern portion of the Watershed. These are steep sloped (15 to 75 percent grade) and highly erosive receiving an average rainfall of about 17 inches. Cattle grazing, agriculture and wildlife habitats are dominant in this region. In the higher elevations of the Watershed the riparian vegetation types are associated with rocky to gravelly channel substrates. Upland scrub and chaparral vegetation types are common in these reaches. Most of these vegetation types are dominated by upland species. Zone 1 is the least developed of the three zones and contains most of the undisturbed upland vegetation within the Watershed.

Zone 2: The San Joaquin Hills (Zone 2) are located in the southern portion of the Watershed, east of Newport Bay and south of the I-405. This zone averages about 13 inches of rainfall per year with slopes ranging from 15 to 75 percent. Land development and wildlife habitats are dominant in this region. This zone is vegetated primarily with grassland and scrub vegetation communities.

Zone 3: The Tustin Plain (Zone 3) occupies the board floodplain of San Diego Creek, Peter's Canyon Wash, and their tributaries between Zones 1 and 2. This zone averages about 13 inches of rainfall per year with slopes ranging from 0 to 15 percent. This zone is almost entirely built out with urban development and/or is largely devoid of native vegetative communities. This area used to be historical flood plain. In Zone 3, most of the historical flood plains and wetlands have been eliminated and replaced with concrete line channels.

3.2.2 Biological Reserves, Designated Wilderness, and Mitigation Areas

As described above, the northern and southern portions of the Watershed support a fairly extensive set of protected areas that preserve, maintain, or restore the natural character of the Watershed, while the central region has been largely developed and/or utilized for agriculture. Together, they form a network of both interconnected and isolated biological communities that support native populations of flora and fauna in this rapidly developing region. The most significant of these protected areas are described below and depicted in Figure 3-6.

<u>Orange County Central/Coastal Natural Community Conservation Plan/Habitat Conservation Plan</u> – The Orange County Central/Coastal NCCP/HCP is a regional conservation plan for the Central and Coastal subregions of Orange County approved in July 1996, by the USFWS and the Department. The NCCP/HCP is designed to provide incentives that will attract landowners, government agencies, and public interests to become stakeholders in a collaborative process. Under the NCCP/HCP approach, the emphasis is placed on protecting covered species (i.e., those species determined to be adequately conserved by the plan, to conserve natural communities and accommodating compatible land uses). Within the Central and Coastal subregions, the NCCP/HCP focuses on creating a multiple-species, multiple-habitat subregional Reserve System and implementing a long-term adaptive management program that will protect coastal sage scrub (CSS) and other habitats and species located within the CSS habitat mosaic, while providing for economic uses that will meet the social and economic needs of the residents and businesses of the subregion. In total, this plan provides for the conservation of 39 identified species including the three target species (i.e., coastal California gnatcatcher, coastal cactus wren, and the orange-throated whiptail) and five habitat types (i.e., coastal sage scrub, oak woodlands, tecate cypress, cliff and rock, and within the coastal subarea, chaparral). The Central/Coastal subregion NCCP/HCP consists of the following elements: (1) a 37,378 acre Reserve System; (2) Special Linkages and Existing Use Areas to enhance biological connectivity within the Reserve System and subregion; (3) an Adaptive Management Program; (4) an Interim Management Plan; (5) Funding; and (6) a mitigation option for non-participating landowners.

The Watershed is located completely in the geographical range covered by the Central/Coastal NCCP/HCP. The following areas of the Watershed are included in the NCCP/HCP Reserve System: Laguna Coast Wilderness Park, Mason Regional Park, Peters Canyon Regional Park, Upper Newport Bay Nature Preserve, Whiting Ranch Wilderness Park, Upper Newport Bay Ecological Reserve, and the University of California Irvine Natural Reserve System.

Figure 3-6. Existing Open Space, Reserves, and Special Linkage Areas

Orange County Regional Parks – Four Regional Parks managed by the County of Orange are located either all or partially within the Watershed. These facilities include the 359-acre Peters Canyon Regional Park, 345-acre William R. Mason Regional Park, 6,300-acre Laguna Coast Wilderness Park, 140-acre Newport Bay Regional Park, and portions of the 1,600-acre Whiting Ranch Wilderness Park. The parks are managed to provide outdoor recreational opportunities in addition to providing some protection of natural areas within the parks. Within the Central/Coastal NCCP/HCP, they are managed as part of the Nature Reserve of Orange County.

MCAS El Toro Habitat Reserve (proposed) – The approximately 900-acre "panhandle" portion in the eastern portion of the former MCAS El Toro is part of the Reserve System established under the Central/Coastal Orange County NCCP/HCP. It is currently owned by the FAA and cooperatively managed by the FAA, the FBI, and the USFWS. Ongoing environmental cleanup activities are being conducted by the U.S. Navy.

Plant communities in the proposed Habitat Reserve include, but are not limited to, a large contiguous area of Venturan-Diegan coastal sage scrub, chaparral, and riparian habitats. The Habitat Reserve supports all three of the target species of the Central/Coastal NCCP/HCP; it contains the largest subpopulation of coastal California gnatcatchers in the Central NCCP/HCP subregion, in addition to a large subpopulation of coastal cactus wrens, and an unknown number of orange-throated whiptails. In addition, the proposed Habitat Reserve area has been designated as critical habitat for the gnatcatcher. Other native species known to occur on the proposed Habitat Reserve include the prostrate spineflower (*Chorizanthe procumbens*), the federally endangered Riverside fairy shrimp, the western spadefoot toad, the San Diego horned lizard, the coastal western whiptail (*Cnemidophorus tigris*), Cooper's hawk (*Accipiter cooperii*), ferruginous hawk (*Buteo regalis*), prairie falcon (*Falco mexicanus*), loggerhead shrike (*Lanius ludovicianus*), southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*), Bell's sage sparrow (*Amphispiza belli belli*), grasshopper sparrow (*Ammodramus savannarum*), San Diego black-tailed jackrabbit (*Lepus californicus bennettii*), and San Diego desert woodrat (*Neotoma lepida intermedia*). Borrego Canyon Wash traverses the southern portion of the Habitat Reserve and supports the coast live oak woodland, southern sycamore riparian woodland, and southern willow scrub that occur on the proposed Habitat Reserve.

San Joaquin Marsh – The 538-acre San Joaquin Marsh (the Marsh), located in the City of Irvine, is a remnant of an approximately 5,300-acre wetland ecosystem that historically existed near the mouths of the Santa Ana River and San Diego Creek prior to flood control modifications. The Marsh is comprised of the 202-acre San Joaquin Marsh Reserve, owned and managed by the University of California Natural Reserve System, and a 336-acre eastern portion owned by the Irvine Ranch Water District. A 29.5-acre parcel in the eastern Marsh houses the Sea and Sage Chapter of the National Audubon Society. Mitigation for development projects by The Irvine Company has been conducted as part of the San Joaquin Marsh Mitigation Project (SJMMP), consisting of 42.5 acres of wetland restoration in the eastern Marsh.

Despite human encroachment and historical modifications to hydrology and water quality, the Marsh still provides an important linkage between the riparian habitats in the Watershed and estuarine habitats in the Upper Newport Bay Ecological Reserve. The Marsh provides nesting, foraging, and stopover habitat for numerous birds as well as habitat for other wildlife species. A variety of habitat types are provided in the Marsh, harboring or potentially harboring 54 sensitive species. Fewer sensitive species have been observed in the SJMMP, though a territorial male least Bell's vireo was observed in the mitigation area in 1999.

Clean Water Act Section 404 Compensatory Mitigation Sites **–** The Corps has preliminarily identified over 50 sites in the Watershed established as mitigation for impacts to waters of the U.S. under the CWA.

3.2.3 Existing Upland Vegetation Communities

The Watershed is highly urbanized and has a variety of habitat types and their acreage based on studies undertaken during the preparation of the Central - Coastal NCCP/HCP are presented in Table 3-7. Approximately 70 percent of the land in the Watershed is developed, disturbed, or agricultural, most of which is located within Zone 3. The predominant vegetation types are coastal sage scrub and chaparral at higher elevations (primarily Zones 1 and 2) and grasslands at lower elevations (primarily Zone 2).

Table 3-7. Upland Habitat Types in the Watershed Based on the NCCP GIS Database

Vegetation Types	Acres	Percent
Dunes	1.7	<1%
Scrub	9,838.4	13%
Chaparral	1,272.2	2%
Grassland	9,285.2	12%
Woodland	311.1	<1
Vernal pools	30.2	<1
Cliff and Rock	68.1	<1%
Agriculture	12,653.8	17%
Developed	36,972.9	49%
Disturbed	3,418.6	4%
APPROXIMATE TOTAL	**73,852.2**	**97%**

Note: Information presented is based on data from the County of Orange GIS, but does not include riparian habitats – "riparian", "lakes and reservoirs", "marsh" and "watercourses". Riparian and wetland resources comprise approximately 3 percent of the Watershed. Furthermore, information presented in Table 3.2-1 is based on data from the County of Orange GIS, collected during the preparation of the Central & Coastal NCCP/HCP in 1995. The habitat designations and associated acreages presented in this table are generalized and approximate and should not be taken literally. For instance, the 30.2 acres of vernal pools reported by the County is inaccurate. Based on more recent vegetation mapping in these areas, the acres of vernal pools is actually less than one acre. Also, percentages for agriculture and developed areas are based on the 1995 GIS data and are currently outdated; agriculture is currently less than 17% and developed areas is greater than 49%.

The following descriptions of the upland vegetation communities and locations identified in the Watershed are taken from Holland (1986). Other cover types mapped in the Watershed such as agriculture, developed lands, and disturbed lands are also discussed. The Watershed encompasses a wide variety of habitat types ranging from mountainous and coastal foothills to central flatlands. In preparation of the Central & Coastal NCCP/HCP, the County of Orange identified 10 upland habitats that occur in the Watershed. For the purposes of this document, the County's (or otherwise stated) upland habitat types are used as the basis for impact analysis in areas outside the Corps and the Department's jurisdiction. A description of the upland habitats is provided below. Please note that vernal pools have been included in this section concerning upland habitat because vernal pools are generally not subject to the Department's jurisdiction or Corps jurisdiction unless a hydrologic connection to navigable waters of the U.S. can be demonstrated.

Scrub

Scrub communities are generally dominated by small shrubs with drought deciduous leaves. Most of the plant species found within these communities regenerate following fire events. "Scrub" as defined for this subregion, roughly corresponds to Holland's (1986) descriptions of Diegan/Venturan coastal sage scrub (a transitional community containing elements of two major types described by Holland), southern coastal bluff scrub, and Riversidean coastal sage scrub. In the subregion, scrub is more or less open community composed of low, drought deciduous shrubs, with a sparse understory of annual and perennial grasses and forbs.

Venturan/Diegan Sage Scrub is a variable community that occurs on rocky, well-drained slopes away from the immediate coast (where it is replaced by the "coastal bluff scrub" community). Coastal sage scrub vegetation varies between relatively moist (mesic) and relatively dry (xeric) sites. Xeric habitats occur on ridges, terraces, and south-facing slopes and include species such as California sagebrush (*Artemisia californica*), buckwheat (*Eriognum fasimlatum*), white sage (*Salvia apiana*), black sage (*Salvia mellifera*), bush monkeyflower (*Mimulus auranticus*), bush sunflower (Encelia californica), deerweed (*Lotus scoparius*), and goldenbush (*Isocoma* spp.). Mesic sites generally occur in microhabitats characterized by north-facing slopes, in canyons and small drainages and include species such as lemonadeberry (*Rhus integrifolia*) and Toyon (*Heteromeles arbutifolia*).

Another community intermixed with coastal sage scrub is southern cactus scrub. Southern cactus scrub contains greater than 20 percent cactus (*Opuntia* spp.); the remainder of the community consists of other typical Venturan/Diegan sage scrub species. This community occurs primarily on south facing slopes on low foothill away from the immediate coast.

These communities often occur on xeric sites such as south facing slopes and provide structures for shelter and nesting. This habitat type is the most common within the Watershed making up approximately 13 percent of the total area and this community dominates much of Zones 1 and 2.

Chaparral

Chaparral communities are dominated by large arborescent shrubs that generally have large evergreen leaves. Most chaparral plant species regenerate from underground root structures following fire events. These communities generally occur on mesic sites such as north facing slopes. Chaparral is a plant association consisting of tall, evergreen, sclerophyllus shrubs requiring more moisture than coastal sage scrub, and typically occurs at higher elevations than scrub associations. Higher elevation chaparral is dominated by species such as chamise (*Adenostema fasciculatum*), ceanothus (*Ceanothus* spp.), scrub oak (*Quercus berberidifolia*), and manzanita (*Archtostaphylos* spp.). Chaparral found close to the coast is dominated by Toyon (*Heteromeles arbutifolia*), laurel sumac (*Malosma laurina*), lemonadeberry (*Rhus integrifolia*), and holly-leaved redberry (*Rhamnus ilicifolia*). This habitat type comprises approximately 2 percent of the Watershed area and dominates much of Zones 1 and 2.

Grassland

Grasslands consist of low-growing herbaceous species dominated by annual, ruderal, and perennial grasses and forbs. The native grassland communities that once blanketed the southern California landscape have largely been outcompeted by non-native annual grasslands. Extant native grasslands are presently restricted to designated open space areas contained within the NCCP reserve system. This habitat type comprises approximately 12 percent of the Watershed area and dominates much of Zone 2.

Annual grassland consists primarily of annual grasses that are dominated by species Mediterranean in origin. Common grasses include Bromes, Oats, Fescues, and Barleys (*Hordeum* ssp.). Many species of native forbs and bulbs, as well as naturalized annual forbs, may be found in annual grasslands, but floristic richness is affected to a high degree by land use activity, such as intensity and duration of grazing. Heavily grazed grasslands have considerably lower species richness. Annual grasslands are generally found on gradual slopes with deep soils.

The most common grassland sub-association within the Watershed is grasslands supporting ruderal species. Ruderal grasslands are dominated by tall, early successional forb species that colonize disturbed sites. Sweet clover (*Melilotus* spp.) and mustards (e.g., *Brassica nigra* and *Hirschfeldia incana*) dominate these grasslands in early spring, replaced by tocalote (*Centaurea melitensis*), cheeseweed (*Malva* spp.) and tumbleweed (*Salsola tragus*) in late spring and summer. Ruderal grasslands differ in density and diversity depending on species composition and soil conditions. Ruderal grasslands are scattered throughout the Watershed primarily occurring in fallow agricultural fields, along manufactured berms and abandoned roads.

Native perennial grasslands occur on clay or clay loam soils, and in areas where grazing and past agricultural uses were less intensive. These native grasslands persist as mosaic patches within and adjacent to non-native annual grasslands and coastal sage scrub. These small isolated patches occur on hilltops, slopes or on rocky slopes.

Woodlands

Woodland habitats consist of multilayered vegetation with tree canopy cover between 20 and 80 percent dominated by Coast live oak (*Quercus agrifolia*). Coast live oak woodlands occur in moist areas with deep soil, along canyon bottoms, valleys and on north-facing slopes or in shaded ravines, and intergrades with coastal sage scrub or chaparral on drier sites. The shrub layer may include species, such as toyon, laurel sumac, lemonadeberry, holly-leaved redberry, and fuchsia-flowered gooseberry (*Ribes speciosum*). The herbaceous component is continuous and often dominated by nonnative grasses and weedy herbs. This habitat type comprises less than one percent of the Watershed and has been identified in Zones 1 and 2.

Vernal pools

Vernal pools are a highly specialized plant habitat occurring on undeveloped mesa tops and supporting a unique succession of floral species. These pools fill with rainwater that does not drain off or percolate away because of the mesa top topography and underlying soil conditions (i.e., a hardpan or claypan layer that prevents or impedes subsurface drainage). Vernal pools are a low, mesic, herbaceous community dominated by annual herbs and grasses. Many sensitive plant species have a potential to occur in these pools, such as Parish's Brittlescale (*Atriplex coulteri*,), Thread-leaved Brodiaeae (*Brodiaea filifolia*), and Mesa Brodiaea (*Brodiaea jolonesis*). Vernal pools were formerly extensive in southern California, but have been largely extirpated by urban development. In addition to providing breeding pools for a variety of amphibians, vernal pools also provide habitat for endangered wildlife, such as the federally endangered San Diego and Riverside Fairy Shrimp. This habitat type comprises less than one percent of the Watershed and has been identified in Zone 2.

It should be noted that the 30.2 acres of vernal pools reported by the County of Orange GIS, collected during the preparation of the Central- Coastal NCCP/HCP in 1995, is inaccurate. Based on more recent vegetation mapping in these areas, vernal pools actually comprise less than 1 acre.

Dune

Only 1.7 acres of this habitat are located within the Watershed, primarily along the coast. Dunes are typically barren, mobile sand accumulations whose size and shape are determined by abiotic site factors rather than by stabilizing vegetation. Dune size and shape vary with wind direction and speed, site topography, sand source, and grain size. This community may include species such as sea rocket (*Cakile maritima*), sea fig (*Carpobrotus chilensis*), beach morning (*Calystegia soldanella*), and beach morning glory (*Camissonia cheiranthifolia*). This habitat type comprises less than one percent of the Watershed and has been identified in Zone 2.

Cliff and Rock

Cliff and rock habitats consist of cliff faces and rock outcrops. Percent plant cover is typically low in these areas, but because of the unique physical conditions these areas may support sensitive plant species. This habitat type comprises less than one percent of the Watershed and has been identified in Zone 1.

Agriculture

The remaining agricultural areas consist of irrigated lands with crop rows and orchards. Agricultural areas are generally devoid of native vegetation and are located in a few non-mountainous portions of the Watershed. The orchards are also devoid of native vegetation and consist of rows of commercial fruit tress, primarily citrus and avocado and are generally located along the mountainous portions of the Watershed. Agricultural lands are present in Zones 1 and 3.

Developed

Developed areas support no native vegetation and may be additionally characterized by the presence of human-made structures such as buildings or roads. The level of soil disturbance is such that only the most ruderal plant species would be expected. The agricultural component of developed areas includes actively cultivated lands or lands that support nursery operations. Developed areas are found in varying densities in rural areas and dominate much of Zone 3.

Disturbed

Disturbed habitat is any land on which the native vegetation has been significantly altered by agriculture, construction, or other land-clearing activities, and the species composition and site conditions are not characteristic of the disturbed phase of one of the plant associations within the study region. Such habitat is typically found in vacant lots, roadsides, construction staging areas, or abandoned fields, and is dominated by nonnative annual species and perennial broadleaf species. Typical plant species include Russian-thistle (*Salsola tragus*), sweet fennel (*Foeniculum vulgare*), horseweed (*Conyza* spp.), mustard, lamb's quarters (*Chenopodium album*), fountain grass (*Pennisetum setaceum*), and castor bean (*Ricinus communis*), among others. Nonnative trees, such as eucalyptus, pepper trees, and Russian olive (*Olea europea*), can also occur in this association. Disturbed habitat is found within Zones 1, 2, and 3.

3.2.4 Threatened and Endangered Wildlife Species

The following discussion identifies federally and state listed threatened and endangered wildlife species known to occur or has the potential to occur within the Watershed. The species identified in this section are based on documented occurrences; presence of suitable habitat (as described above), and/or proximity within a species known range. The mountainous zone, coastal foothills, and the central flats of the Watershed provide a diversity of habitat types distinguished by microclimate, slope aspect, and soil type. These habitats provide nesting, breeding, and foraging habitat for hundreds of wildlife species. Native species include large resident predators such as the mountain lion as well as migratory birds and waterfowl such as the southwestern willow flycatcher that spend only a part of the year along willow dominated riparian corridors. Table 3-8 presents previously detected or potentially occurring threatened or endangered wildlife species within the Watershed.

Table 3-8. Previously Detected or Potentially Occurring Threatened or Endangered Wildlife Species within the San Diego Creek Watershed

Common Name	Scientific Name	Regulatory Status	Habitat Use	Likelihood of Occurring within the San Diego Creek Watershed
Crustacea				
San Diego Fairy Shrimp	*Branchinecta sandiegonensis*	Fed: Endangered State: None NCCP: Conditionally Covered	Vernal pools	Low
Riverside Fairy Shrimp	*Streptocephalus woottoni*	Fed: Endangered State: None NCCP: Conditionally Covered	Vernal pools	High (Detected)
Insects				
Quino Checkerspot Butterfly	*Euphydryas editha quino*	Fed: Endangered State: None NCCP: Conditionally Covered	Coastal sage scrub and chaparral	Low
Fish				
Amphibians				
Arroyo Toad	*Bufo californicus*	Fed: Endangered State: None DFG: CSC NCCP: Conditionally Covered	Riparian and upland habitats	High (Historically Detected)
California Red-legged Frog	*Rana aurora draytonii*	Fed: Threatened State: None DFG: CSC NCCP: ASOI	Riparian habitats	Low
Birds				

Common Name	Scientific Name	Regulatory Status	Habitat Use	Likelihood of Occurring within the San Diego Creek Watershed
California Brown Pelican	*Pelecanus occidentalis californicus*	Fed: Endangered State: Endangered DFG: Fully Protected FWS: MNBMC NCCP: None	Open ocean, rocky and sandy beaches	High
Swainson's Hawk (nesting)	*Buteo swainsoni*	Fed: SC State: Threatened USBC: Watch list Audubon: Watch list NCCP: None	Savannah, prairies, deserts, and open woodlands	Low
Bald Eagle (nesting or wintering)	*Haliaeetus leucocephalus*	Fed: Threatened, FPD State: Endangered DFG: Fully Protected NCCP: None	Lakes, rivers, and estuaries	Low
American Peregrine Falcon (nesting)	*Falco peregrinus anatum*	Fed: Delisted 2002 State: Endangered DFG: Fully protected NCCP: Covered	Cliffs or outcroppings near water; grassland, scrub and marshes	Low
California Black Rail	*Laterallus jamaicensis coturniculus*	Fed: SC State: Threatened DFG: Fully protected USBC: Watch list Audubon: Watch list FWS: MNBMC NCCP: None	Marshes	Low
Light-footed Clapper Rail	*Rallus longirostris levipes*	Fed: Endangered State: Endangered DFG: Fully protected USBC: Watch list NCCP: None	Marshes	Low
Western Snowy Plover (nesting)	*Charadrius alexandrinus nivosus*	Fed: Threatened State: None DFG: CSC FWS: BCC USBC: Watch list Audubon: Watch list NCCP: None	Beaches	Low
California Least Tern	*Sterna antillarum browni*	Fed: Endangered State: Endangered FWS: MNBMC DFG: Fully Protected USBC: Watch list NCCP: None	Estuaries or lagoons	Moderate
Western Yellow-billed Cuckoo (nesting)	*Coccyzus americanus occidentalis*	Fed: Candidate State: Endangered FWS: BCC NCCP: None	Riparian habitats	Low

Common Name	Scientific Name	Regulatory Status	Habitat Use	Likelihood of Occurring within the San Diego Creek Watershed
Southwestern Willow Flycatcher (nesting)	*Empidonax traillii extimus*	Fed: Endangered State: Endangered USBC: Watch list Audubon: Watch list NCCP: Conditionally Covered	Riparian habitats	High (Detected)
Least Bell's Vireo (nesting)	*Vireo belli pusillus*	Fed: Endangered State: Endangered USBC: Watch list Audubon: Watch list FWS: BCC NCCP: Conditionally Covered	Riparian habitats	High (Detected)
Coastal California Gnatcatcher	*Polioptila californica californica*	Fed: Threatened State: None DFG: CSC USBC: Watch list Audubon: Watch list NCCP: Target Species	Coastal sage scrub	High (Detected)
Belding's Savannah Sparrow	*Passerculus sandwichensis beldingi*	Fed: None State: Endangered NCCP: None	Coastal salt marshes	High (Detected)
Mammals				
Pacific Pocket Mouse	*Perognathus longimembris pacificus*	Fed: Endangered State: None DFG: CSC NCCP: Conditionally Covered	Coastal plains with fine sands near the ocean	Low

Fed = Federal listing status
SC = Species of Concern
FWS = U.S. Fish and Wildlife Service
BCC = Birds of Conservation Concern
State = State of California listing status
DFG = California Department of Fish and Game
CSC = California Special Concern species
CNDDB = California Natural Diversity Database
AFS = American Fisheries Society
Fully Protected = May not be take without a permit from the Fish and Game Commission
USBC Watch List = United States Bird Conservation Watch List
Audubon: Watch List = Species facing population declines and/or threats such as habitat loss.
NCCP = Natural Community Conservation Plan and Habitat Conservation Plan for the County of Orange, Central and Coastal Subregion
Target Species: NCCP Target Species receiving regulatory coverage
Covered = NCCP covered species receiving regulatory coverage
Conditionally Covered = NCCP conditionally covered species
ASOI = NCCP additional species of interest
SIS = NCCP special interest species

Aquatic Invertebrates

Given the degraded hydrologic condition of San Diego Creek and its tributaries and poor water quality flows, the creek is expected to contain very few types and low numbers of invertebrate species consisting mainly of soft-bodied animals. Invertebrates observed during surveys conducted by Harmsworth Associates (2002) included species tolerant of poor water quality. The most common taxa observed were flatworms (Tricladida), with common amphipods (Family Hyalellidae) and freshwater clams (Family Sphaeriidae) occurring at lower concentrations. Other species observed included dragonfly larvae (*Anax* sp), fly larvae (Families Chironomidae and Empididae), damselfly larvae (Family Chromagrion), mosquito larvae (*Culex* sp), aquatic worms (Family Lumbriculidae), freshwater snail (*Physa gyrina*) and swamp crayfish (*Procabarus clarki*). One federally listed endangered species (i.e., Riverside fairy shrimp) has been detected within the Watershed.

Fish

Southern California is known for its impoverished native freshwater fish fauna. Freshwater fish expected to occur in the Watershed consist primarily of exotic species that have historically been released for recreational fishing and vector control, and individuals from the pet trade. Non-native fish species known to occur in the Watershed include mosquito fish (*Gambusia affinis*), fathead minnow (*Pimephales promelas*), red shiner (*Cyprinella lutrensis*), carp (*Cyprinus carpio*), green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropteras salmoides*), bullhead (*Ameiurus* sp.), bluegill (*Lepomis macrochirus*), and threadfin shad (*Dorosoma petenense*).

No federal-and state-listed endangered, threatened, or candidate fish species are reported in the Watershed.

Amphibians

Amphibia are a diverse group consisting of frogs and toads, salamanders and newts, and caecilians or legless Amphibia. The frogs, toads, and newts require water for breeding, for laying their eggs, and for the subsequent tadpole stage. After metamorphosis, they become at least partially terrestrial and often move away from water. The arroyo toad (*Bufo californicus*) is the only amphibian species listed as endangered in Orange County. Although known to have historically occurred within the Watershed, recent surveys for Arroyo Toads have not detected their presence. The western spadefoot (*Scaphiopus hammondi*) and the coast range newt (*Taricha torosa torosa*) are both listed as species of special concern to the State of California. Common amphibian species occurring within the Watershed include the Pacific chorus frog (*Hyla regilla*) and the California tree frog (*Hyla cadaverina*). The western toad (*Bufo boreas*) is also common throughout native areas of Orange County. Two invasive species, the bullfrog (*Rana catesbeiana*) and the African clawed frog (*Xenopus laevis*), also occur in the Watershed. No federal-and state-listed endangered, threatened, or candidate amphibian species are reported in the Watershed.

Reptiles

Over 50 reptile species occur in southern California. Reptile species expected to occur in the Watershed include species such as Southwestern pond turtle (Clemmys *marmorata pallida)* side-blotched lizard (*Uta stansburiana*), western fence lizard (*Sceloporus occidentalis*), southern alligator lizard (*Elgaria multicarinatus*), coastal western whiptail (*Cnemidophorus tigris tigris*), coachwhip (*Masticophis flagellum*), two-striped garter snake (*Thamnophis hammondii*), south coast garter snake (*Thamnophis sirtalis* spp.), common kingsnake (*Lampropeltis getulus*), and Southern Pacific rattlesnake (*Crotalus* *viridis heleri*). Non-native reptile species expected to occur within the Watershed include the red-eared slider (*Pseudemys scripta elegans*), yellow-bellied slider (*Pseudemys scripta scripta*), and spiny softshell (*Trionyx spiniferus*). No federal-and state-listed endangered, threatened, or candidate reptile species are reported in the Watershed.

Birds

Over 440 native bird species have been recorded in Orange County (Hamilton 1996). A total of 132 avian species were recorded within the Watershed during surveys by Harmsworth Associated in 1999. Birds occurring in the Watershed include locally common birds, such as mourning dove (*Zenaida macroura*), northern mockingbird (*Mimus polyglottos*), house finch (*Carpodacus mexicanus*), and black phoebe (*Sayornis nigricans*); residential birds, such as California towee (*Pipilo crissalis*) and coastal California gnatcatcher (*Polioptila californica californica*); wintering birds, particularly near Newport Bay, such as willet (*Catoptrophorus semipalmatus*), greater yellowlegs (*Tringa melanoleuca*), long-billed curlew (*Numenius americanus*), and western sandpiper (*Calidris mauri*), western grebe (*Aechmophorus occidentalis*), northern shoveler (*Anas clypeata*), northern pintail (*Anas acuta*), and American coot (*Fulica americana*); and migratory birds, such as cedar waxwing (*Bombycilla cedrorum*), western wood-pewee (*Contopus sordidulus*), warbling vireo (*Vireo gilvus*), Wilson's warbler (*Wilsonia pusilla*), and Bullock's oriole (*Icterus bullockii*).

Of the 29 raptor species detected in Orange County, only 18 are seen on a regular basis from year to year. Some of the more common raptor species include Turkey Vulture, Red-shouldered Hawk, Cooper's Hawk, Red-shouldered Hawk, Barn Owl, and Western Screech Owl.

Focused surveys for the federally threatened coastal California gnatcatcher and state and federally endangered least Bell's vireo and southwestern willow flycatcher (*Empidonax traillii extimus*) revealed numerous populations within the Watershed.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*): Southwestern willow flycatcher, a state and federally-listed endangered species, breeds from southern California through Arizona, New Mexico, the extreme southern part of Nevada and Utah, and western Texas. Nesting records for this subspecies are from the south fork of the Kern River, Camp Pendleton, and a few other disjunct locations in southern California.

Southwestern willow flycatchers inhabit and nest along waterways with dense riparian vegetation. They are summer residents in California from mid-April through September. Breeding begins in mid-April. The southwestern willow flycatchers prefer extensive thickets of low, dense willows on the edge of wet meadows, ponds, or backwaters. The presence of surface water such as slow moving streams, standing water or seeps seems to be important during the spring for nesting; however, streams may be dry during the summer months after nesting is completed. They will use a broad range of willow habitats, but prefer clumps of bushes interspersed with open areas, rather than dense continuous thickets. Thickets of trees and shrubs most commonly used are approximately 4 to 7 meters tall, with a high percentage of canopy cover and dense foliage of 0 to 4 meters above ground. Willow flycatchers nest primarily in willows and mule fat (*Baccharis salicifolia*); however, they have been known to nest in areas dominated by salt cedar

(*Tamarisk sp.)* or Russian olive. Migrant individuals are common in the spring (mid-May to early June) and fall (mid-August to early September).

<u>Least Bell's Vireo (*Vireo bellii pusillus*):</u> Least Bell's vireo, a federal- and state-listed endangered species, is a summer resident of southern California in areas below 2,000 feet in elevation. It winters in Latin America and migrates into its breeding range near the end of March. This species inhabits and nests along waterways with willow riparian thickets mainly along the coast and the western edge of the Mojave Desert. The breeding season for the least Bell's vireo extends from April through the end of July. It typically inhabits low riparian growth, either adjacent to water or in dry river bottoms. This species builds its nests along margins of riparian vegetation, usually in moist thickets and riparian areas that are predominately composed of willow or mule fat. One of the most critical structural components of a riparian zone suitable for vireos is the presence of a dense shrub layer from 2.0 to 9.9 feet above the ground. Plant communities used by least Bell's vireos include willow-cottonwood forest, oak woodland, shrubby thickets and dry washes established with arroyo willows, etc.

<u>Coastal California Gnatcatcher (*Polioptila californica californica*):</u> The coastal California gnatcatcher, was listed as threatened by the USFWS in 1993. The gnatcatcher is a non-migratory songbird that nests and forages in moderately dense stands of coastal sage scrub occurring on arid hillsides, mesas, and washes. Habitat loss, degradation and fragmentation due to land alteration and development are considered the major threats to this species. Coastal California gnatcatchers are also subject to nest parasitism by the brown-headed cowbird. Final designation of critical habitat was published in the *Federal Register* on October 24, 2000 (See Section 3.2.6).

The coastal California gnatcatcher is a small, gray, insect-gleaning bird typically associated with different coastal sage scrub plant communities. California sagebrush (*Artemisia californica*) dominated stands of coastal sage scrub are preferred by the coastal California gnatcatcher. Other species that may be present include white sage (*Salvia apiana*), California bush sunflower (*Encelia californica*), and California buckwheat (*Eriogonum fasiciulatum*). The birds do not appear to be obligatorily dependent on any particular plant species found in coastal sage scrub, rather they typically avoid habitats that are either very sparse or extensively invaded by taller shrubs and trees or by non-native plant species.

This bird is a year-round resident. Breeding pairs become highly territorial by late February or early March. Nest building begins during the second or third week of March with fledglings starting to appear around May 1. Post-breeding dispersal of fledglings occurs between late May and late November. During the breeding season (i.e., from mid-February through July), the birds form monogamous pairs, defending a territory from other gnatcatchers and nesting persistently. They may make as many as 10 nesting attempts in a season.

Mammals

Approximately 79 terrestrial mammals occur in Southern California. Small mammal species expected to occur in the Watershed include species such as desert cottontail (*Sylvilagus audubonii*), California ground squirrel (*Spermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), San Diego pocket mouse (*Chaetodipus fallax*), California vole (*Microtus californicus*), house mouse (*Mus musculus*), dusky-footed woodrat (*Neotoma fuscipes*), deer mouse (*Peromyscus maniculatus*), and black rat (*Rattus rattus*).

Common bat species expected to occur in the Watershed include species such as big brown bat (Eptesicus fuscus), western red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), California myotis (*Myotis californicus*), and eastern small-footed myotis (*Myotis leibii*).

Larger mammal species expected to occur in the Watershed include species such as Virginia opossum (*Didalphis virginiana*), mountain lion (*Puma concolor californicus*), bob cat (*Felis rufus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and mule deer (*Odocoileus hemionus*).

No federal-and state-listed endangered, threatened, or candidate mammal species are reported in the Watershed.

Wildlife Summary

In summary, a total of 20 federal- and state-listed endangered and threatened wildlife species have been identified as historically, currently, or potentially occurring within the Watershed. Of these, six wildlife species have been identified as currently occupying the Watershed. Of these listed species previously detected within the Watershed, four species are reliant on riparian ecosystems (i.e., California least tern, southwestern willow flycatcher, least Bell's vireo, and Belding's savannah sparrow) and two species are not associated with riparian ecosystems (i.e., coastal California gnatcatcher and Riverside fairy shrimp).

3.2.5 Threatened and Endangered Plant Resources

This section provides a brief description of nine sensitive plant species that are federal-and state-listed as endangered or threatened that occur or have the potential to occur within the Watershed. Table 3-9 presents previously detected or potentially occurring threatened or endangered plant species within the Watershed.

Table 3-9. Previously Detected or Potentially Occurring Threatened or Endangered Plant Species within the San Diego Creek Watershed

Common Name	Scientific Name	Regulatory Status	Habitat Use/Life Form/ Blooming Period	Likelihood of Occurring within the San Diego Creek Watershed
Plants				
Braunton's rattleweed (milk- vetch)	*Astragalus brauntonii*	Fed: Endangered State: None CNPS: 1B NCCP: ASOI	Native grasslands, coastal sage scrub, chaparral, forests (Fire follower)/ perennial herb/ March-July	Low
Thread-leaved brodieaea	*Brodiaea filifolia*	Fed: Threatened State: Endangered CNPS: 1B NCCP: ASOI	Native grasslands, coastal sage scrub, woodlands, clay soils, vernal pools/ perennial herb/ March-June	Low
San Fernando Valley Spineflower	*Chorizanthe parryi var fernandina*	Fed: Candidate State: Endangered CNPS: 1B NCCP: None	Sandy soils in Coastal Sage Scrub/ annual herb/ April-June	Low
Salt marsh Bird's Beak	*Cordylanthus maritimus* ssp. *maritimus*	Fed: Endangered State: Endangered CNPS: 1B NCCP: None	Salt marsh habitat/ annual herb/ late summer	High (Previously Detected)
Slender-horned Spineflower	*Dodecahema leptoceras*	Fed: Endangered State: Endangered CNPS: 1B NCCP: None	Sandy soils in chaparral, woodlands, and alluvial sage scrub/ annual herb/ April-June	Low
Santa Monica Mountains Dudleya	*Dudleya cymosa* spp. *ovatifolia*	Fed: Threatened State: None CNPS: 1B NCCP: Covered	Chaparral and coastal sage scrub between 490 to 5,500 feet amsl/ perennial herb/ April-June	Low
Laguna Beach Dudleya	*Dudleya stolonifera*	Fed: Threatened State: Threatened CNPS: 1B NCCP: Covered & ASOI	Coastal sage scrub or chaparral on weathered sandstone rock outcrops/ perennial herb/ May to July	Low
Gambell's Water Cress	*Rorippa gambelii*	Fed: Endangered State: Threatened CNPS: 1B NCCP: None	Marshes and swamps/ perennial herb/ April-June	Low
Crownbeard	*Verbesina dissita*	Fed: Threatened State: Threatened CNPS: 1B NCCP: ASOI & SIS	Maritime chaparral, coastal sage scrub/ perennial herb/ April-June	Low

Refer to Table 38 for a list of abbreviation definitions used in the above table.

Braunton's milk-vetch *(Astragalus brauntonii)*, a federal-listed endangered plant, is a large, perennial herbaceous plant flowering from March through July. It occurs in chaparral, coastal sage scrub, closed-cone coniferous forest and valley and foothill grassland communities. This species is typically found in recently burned or disturbed areas on carbonate soils at elevations between 10 and 2,100 feet above mean sea level (msl). There is moderate potential for this species to occur in the sagebrush-buckwheat scrub communities surrounding Bee, Hicks, East Hicks, and Round retarding basins. There is also a moderate potential for this species to occur in the annual grasslands of Agua Chinon or Marshburn basins and a low potential for this species to occur in the non-native grasslands of Hicks and East Hicks basins.

Thread-leaved brodiaea *(Brodiaea filifolia)* is a federal-listed threatened and state-listed endangered species on the CNPS 1 B List. It is a bulbiferous herb blooming from March to June that occurs in openings in chaparral, cismontane woodland, coastal scrub, playas, valley and foothill grasslands, and vernal pools (often clay soils). The elevation of this species ranges from 100 to 4,000 feet above msl. There is moderate potential for this species to occur in the sagebrush-buckwheat scrub communities surrounding Bee, Hicks, East Hicks, and Round retarding basins. There is also a moderate potential for this species to occur in the annual grasslands of Agua Chinon or Marshburn basins and a low potential for this species to occur in the non-native grasslands of Hicks and East Hicks basins.

San Fernando Valley spineflower *(Chorizanthe parryi* var. *Fernandina)* is a federal-listed candidate, state-listed endangered, and a CNPS List 1 B species previously presumed extinct but rediscovered in 2001. This annual herb blooms from April to June and occurs on dry, sandy soils between elevations of 500 and 4,000 feet above msl, mostly in coastal sage scrub habitats. There is moderate potential for this species to occur in the sagebrush-buckwheat scrub communities surrounding Bee, Hicks, East Hicks, and Round retarding basins.

Salt marsh bird's-beak *(Cordylanthus maritimus* ssp. *maritimus)* is a federal- and state-listed as endangered and is also listed on the CNPS 1 B list. This hemiparasitic annual herb blooms between May and October and occurs in coastal dunes and coastal salt marshes and swamps usually up to 100 feet above msl in elevation. There is a high potential for this species to occur in the Watershed and this species has previously been observed within the Watershed**.**

Slender-horned spineflower *(Dodecahema leptoceras)* is a federal- and state-listed endangered species. This annual herb blooms from April to June and occurs in chaparral, cismontane woodlands, and coastal scrub, particularly alluvial fan sage scrub, on flood deposited terraces and washes at an elevation between approximately 660 and 2,500 feet above msl. There is moderate potential for this species to occur in the sagebrush-buckwheat scrub communities surrounding Bee, Hicks, East Hicks, and Round retarding basins.

Santa Monica Mountains dudleya *(Dudleya cymosa* ssp. *ovatifolia)* is a federal-listed threatened species with no state rarity status. This perennial herb flowers from March to June and occurs in chaparral, coastal scrub, and grasslands on north-facing, rocky outcrops of volcanic origin at elevations of 490 to 5,500 feet above msl. There is low potential for this species to occur in the sagebrush-buckwheat scrub communities surrounding Bee, Hicks, East Hicks, and Round retarding basins.

Laguna Beach dudleya *(Dudleya stolonifera)* is a federal- and state-listed threatened species. It is a stoloniferous perennial herb, blooming from May to July and occurs in coastal scrub, chaparral, cis montane woodland, and valley and foothill grassland on rocky soils. Elevations range from 30 to 850 feet above msl. There is low potential for this species to occur in the sagebrush-buckwheat scrub communities surrounding Bee, Hicks, East Hicks, and Round retarding basins.

California Orcutt grass *(Orcultia californica)* is a federal- and state-listed endangered species that is also listed on the CNPS 1 B list. This annual grass species flowers from April to August and is found in vernal pools at elevations between 50 and 2,170 feet above msl. This species is restricted to habitat that is not present within any of the channels or retarding basins.

Gambel's water cress *(Rorippa gambelii)* is a federal- and state-listed endangered species that is also listed on the CNPS 1B list. This rhizomatous perennial herb flowers from April to September. It occurs in freshwater or brackish marshes and swamps between 15 and 1,080 feet above msl in elevation. There is moderate potential for this species to occur in the freshwater seeps and marshes of channels F07, F08, and F09.

Crown beard *(Verbesina dissita)* is a federal- and state-listed threatened species. It is a perennial herb that flowers from April to July. Habitat for the crown beard is found in coastal scrub and chaparral on gravelly soils at elevations between 150 and 690 feet above msl. There is low potential for this species to occur in the sagebrush-buckwheat scrub communities surrounding Bee, Hicks, East Hicks, and Round retarding basins.

3.2.6 Critical Habitat

The USFWS has designated critical habitat for one species within the Watershed - the coastal California gnatcatcher. Critical habitat is defined in Section 3 of the FESA as:

> *the specific areas within the geographical areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection: and (ii) specific area outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.*

"Critical habitat" is a designation used by the USFWS in its administration of the FESA and applies only to the actions of federal agencies. Specifically, federal agencies, if conducting activities on lands designated as critical habitat, are to consult with the USFWS to ensure that their federal actions do not "adversely modify" critical habitat. According to the USFWS, a critical habitat designation is not to have any impact on private property included within the designation, absent federal activity on that property. The USFWS has adopted a "landscape approach" to its designation of critical habitat for the coastal California gnatcatcher, which is not intended to highlight individual parcels of private property. Furthermore, the USFWS recognizes that "not all parcels of land within the areas designated will contain the habitat components essential to gnatcatcher conservation"; and the USFWS has noted that some gnatcatcher habitat loss within designated critical habitat is not likely to adversely modify or destroy critical habitat or appreciably reduce its value for the survival and recovery of the species.

California sagebrush-dominated stands of coastal sage scrub are preferred by the coastal California gnatcatcher. Other species that may be present include white sage, California bush sunflower, and California buckwheat. The birds do not appear to be obligatorily dependent on any particular plant species found in coastal sage scrub; rather they typically avoid habitats that are either very sparse or extensively invaded by taller shrubs and trees or by non-native plant species. This plant community is considered to be declining throughout the region and has been subject to extensive displacement and degradation as urbanization continues throughout southern California. Urbanization has also resulted in increased fragmentation and isolation of remaining coastal sage scrub communities.

<u>Coastal California Gnatcatcher Critical Habitat within the San Diego Creek Watershed</u>: The USFWS has designated approximately 1,557 acres of coastal sage scrub critical habitat (the critical habitat falls within critical habitat Unit 7 as designated by the USFWS) for the coastal California gnatcatcher within the Watershed. Critical habitat has been designated for two sites located within the northern portion of Watershed (i.e., Zone 1) and one site located within the southern portion of the Watershed (i.e., Zone 2). No critical habitat has been designated with the central region of the Watershed (i.e., Zone 3). Approximately 236 acres are associated with western portion of Zone 1 (i.e., Peters Canyon Reservoir site), 1,001 acres are associated with eastern portion of Zone 1, and 320 acres are associated with Zone 2 (i.e., University of California, Irvine).

3.2.7 Wildlife Movement Corridors

<u>Importance of Wildlife Corridors:</u>

In Southern California, where natural areas are often scarce and wildlife reserves are continually being encroached upon and surrounded by development, connectivity between these significant habitats is perhaps one of the best feasible options for preventing localized extinctions and/or enhancing biodiversity. While the debate over the value of corridors has been extensive (Simberloff & Cox 1987, Beier & Loe 1992, Beier & Noss 1998), most authorities seem to agree that if conservation corridors are used in appropriate situations and designed properly, they can be useful conservation tools.

In addition to providing routes for migration and dispersal, several studies have demonstrated the importance of corridors in preventing extinctions and increasing species diversity (Fahrig & Merriam 1985, Crooks 2002, Crooks & Soulé 1999). Corridors also play a very important role in linking reserves and reducing the dire effects of fragmentation. While corridors are not reserves themselves, they can be viewed as a means to effectively increase reserve size. To some wide-ranging animals such as bobcat, coyote, mountain lion, and mule deer, even a relatively large isolated reserve may not be capable of sustaining populations. However, by allowing these and other species to disperse to and move between reserves via wildlife corridors, these animals have more space to utilize and are more likely to maintain stable populations.

Wildlife corridors or wildlife linkages link together areas of suitable wildlife habitat that are otherwise separated by rugged terrain, changes in vegetation, or human disturbance. The fragmentation of open space areas by urbanization creates isolated "islands" of wildlife habitat. Wildlife species, especially the larger and more mobile mammals, will not likely persist over time in fragmented or isolated habitat areas because these conditions prohibit the infusion of new individuals and genetic information. Wildlife linkages mitigate the effects of this fragmentation by: (1) allowing animals to move between remaining habitats, thereby permitting depleted populations to be replenished and promoting genetic exchange; (2) providing escape routes from fire, predators, and human disturbances, thus reducing the effects of catastrophic events, such as fire or disease that could result in population or local species extinction; and (3) serving as travel routes for individual animals as they move in their home ranges in search of food, water, mates, and other necessary resources.

Existing Conditions:

As previously described, the remaining stands of native vegetation within the southern portion of the Watershed (Zone 2) has been largely cut off from northern portion (Zone 1) by the urban and agricultural development within the central region of the Watershed (Zone 3).

The northern reserve land is predominantly part of the Limestone-Whiting Wilderness Park and the proposed MCAS El Toro Habitat Reserve. These areas contain some very diverse terrain, from the flat, open grasslands of the Refuge up to the rugged hills, canyons, and mountains that define the northern horizon. The lowest areas are predominantly grassland and coastal sage scrub habitats, with the latter extending partway up into the foothills. Eventually, chaparral takes over and dominates the higher elevations with its thicker, brushy cover. Within the canyons and along streams, the other habitats often yield to coastal live oak woodlands and narrow forests of sycamores and willows typically found in these riparian areas.

The southern reserve land is predominantly part of the Irvine Open Space Preserves, Laguna Coast Wilderness Park, and Crystal Cove State Park that are important resources, since so little natural habitat remains this close to the coast in Southern California. These areas provide many of the same habitats as the northern reserves, including coastal sage scrub, more expansive riparian areas, and lower-elevation maritime chaparral.

The preservation and/or the establishment of wildlife corridors can increase the functionality and viability of both the northern and southern reserves. Figure 3-7 shows potential wildlife movement corridors for the Watershed.

Figure 3-7. Potential Wildlife Movement Corridors

3.3 HYDROLOGY, EROSION AND SEDIMENTATION

3.3.1 Hydrologic Conditions

The Watershed encompasses approximately 122 square miles or 78,000 acres in central Orange County, California (see Figure 1-1b in Section 1). Developed areas within the Watershed include portions of Santa Ana, Orange, Tustin, Laguna Hills, Newport Beach, Irvine, Lake Forest, Laguna Woods and unincorporated areas of Orange County. Land uses within the Watershed consist of primarily urban (residential, commercial, industrial, institutional uses), and some agriculture and open space areas.

The Watershed is drained by San Diego Creek, from the north and east, flowing westerly where it discharges into Upper Newport Bay in the City of Newport Beach. Key drainages of the Watershed include:

- Peters Canyon Wash
- Rattlesnake Canyon Wash
- Round Canyon Wash
- Borrego Canyon Wash
- Bommer Canyon Creek
- Trabuco Channel
- Sand Canyon Wash
- Hicks Canyon Wash
- Bee Canyon Wash
- Agua Chinon Wash
- Serrano Creek
- Shady Canyon Creek
- Bonita Canyon Wash
- San Diego Creek

Many of these drainages are characterized as natural ephemeral drainages in the upper undeveloped portions of Watershed, and are channelized in the lower more developed portions. The Watershed is comprised of three general topographic relief zones, including a mountainous zone in the northeastern portion of the Watershed (Santiago Hills), a central flat zone (Northern Flatlands and Central Flatlands) in the central and western portions of the Watershed and the coastal foothill zone (San Joaquin Hills) in the southern portions.

The Watershed is partially encircled by hills and ridges, with the Lomas de Santiago Hills to the northeast and the San Joaquin Hills to the south. The runoff from these hills drains across the Tustin Plain via a series of canyon washes, channels (engineered and natural), and culverts into San Diego Creek and ultimately into Upper Newport Bay. The Watershed drains approximately 80 percent of the 154 square miles that are tributary to Upper Newport Bay. Other flows to Upper Newport Bay come from the Santa Ana-Delhi Channel, Big Canyon, and other smaller drainages, which are not included in the Watershed. Landforms and drainage channels for the Watershed, as of December 2003, are shown in Figures 3-8 and 3-9, respectively.

Figure 3-8. Landforms

Figure 3-9. Drainage Channels

Historical Drainage

Over the past century, the majority of drainage courses in the Watershed have been extensively altered and realigned for purposes of urban development, agricultural activities, and flood management. Historically, there were no defined channels existing along the lower reaches of San Diego Creek and Peters Canyon Wash. Storm flow originating from areas of the upper Watershed was intercepted by an ephemeral lake lying within the western portion of the Tustin Plain. Figure 3-10 depicts historic Watershed hydrography.

Historically, San Diego Creek and the small tributaries originating in the Lomas de Santiago Hills drained into an ephemeral lake and marsh area known as the "Swamp of the Frogs" (Cienega de las Ranas). In the later part of last century and early this century, the Watershed underwent considerable changes in land use from ranching/grazing to farming. The "Swamp of the Frogs" was drained, and the vegetation in the marsh cleared to make room for farming. Drainage channels were constructed to augment the farming activity in the area. All of the channels constructed in the Watershed drained to San Diego Creek and eventually Newport Bay. After World War II, land use in the Watershed started shifting from farming to residential and commercial developments. In order to accommodate this development, flood risk management projects were constructed to expand the capacity of the drainages. Changes to the drainage patterns in the Watershed culminated in the channelization of San Diego Creek in the early 1960s by Orange County Flood Control District, which subsequently provided flood management for the surrounding developing areas. Modification to the natural drainages also isolated the San Joaquin Marsh, the last remaining portions of the historic marsh upstream of Upper Newport Bay, from San Diego Creek.

The changes in the Watershed described above resulted in substantial increases in storm water and sediment flows transported in San Diego Creek and deposited into Upper Newport Bay. This in turn resulted in growing concern over the long-term health of the Upper Newport Bay estuarine environment. Several efforts were initiated to address these concerns, including sediment control and a flood management master plan. These measures are described in more detail in the subsection below called Existing Sediment Control Program. These measures engineered the general water quality of the bay and Watershed, reducing the rate of degradation of habitats and shoaling in the navigation channels (Corps, 2000).

Figure 3-10. Historic Watershed Hydrography

Present Drainage Characteristics

The Watershed is presently drained by a series of ephemeral streams, lined and unlined channels and underground storm drains. The principal watercourse is San Diego Creek that drains 122 square miles of the total Watershed. San Diego Creek is the largest contributor of fresh water flows into Upper Newport Bay, with the remaining flows into the Bay coming from the Santa Ana-Delhi Channel, Big Canyon, and other small drainages. The second largest watercourse within the Watershed is Peters Canyon Wash, which, like San Diego Creek, was modified and realigned in the 1960s for flood management purposes. Modifications to both San Diego Creek and Peters Canyon Wash included widening, straightening, and realigning in order to contain and control projected 100-year flood flows and reduce the amount of erosion that was occurring in the natural, steeply sloped channels in response to increased flows. San Diego Creek and Peters Canyon Wash consist of both modified and natural segments for the length of their drainages. Modified segments include such engineered features as rip-rap, concrete-lined trapezoidal channels, grass-lined swales and energy dissipaters. The width, depth, and level of modifications for both drainages vary substantially throughout the Watershed.

Major tributaries of San Diego Creek to the north and east west include: Rattlesnake Canyon, Hicks Canyon, Bee Canyon, Round Canyon Agua Chinon Canyon, Borrego Canyon, and Serrano Creek. Tributaries to the south and west include Bonita Creek and Sand Canyon Wash (including Bommer Canyon and Shady Canyon). The highly urbanized areas north and west within Santa Ana, Orange, Costa Mesa and Tustin are drained to San Diego Creek via a number of concrete-lined channels including El Modena-Irvine Channel, Tustin Channel, Santa Fe Channel, Red Hill Channel, Como Channel and the Barranca Channel. Major drainages and channels of the Watershed are shown on Figure 3-9 and listed in the Table 3-10.

Table 3-10. Drainage Channels of the San Diego Creek Watershed

San Diego Creek Watershed Drainages	Drainage Characteristics
San Diego Creek Mainstem	
San Diego Creek Channel	Drainage originates in eastern portion of the Watershed and flows westerly through undeveloped foothills of Irvine and urbanized cities of Newport Beach, Irvine, and Lake Forest. Channelized, with lined and unlined portions.
Lane Channel	Originates in western portion of the Watershed within City of Santa Ana, and drains southeasterly into San Diego Creek. Engineered channel through cities of Costa Mesa, Irvine, Santa Ana.
Armstrong Storm Channel	Engineered channel through Irvine.
San Joaquin Channel	Originates in San Joaquin Hills and drains westerly into San Diego Creek. Combination of natural watercourse and engineered channel through the City of Irvine. Upstream limit of engineered portion begins at the I-405 and Sand Canyon Ave intersection.
Culver Storm Channel	Engineered channel through portion of Irvine.
Sand Canyon Channel	Partially engineered channel through Irvine. Upstream limit of engineered portion begins at Intersection of Ridgeline Drive and University Drive.
Marshburn Channel	Drainage originates in lower Lomas de Santiago foothills and drains southwesterly. Partially engineered channel through Irvine and former MCAS El Toro. Engineered portion extends upstream from Waterworks Way in Irvine to I-5 Freeway.
Central Irvine Channel	Drainage originates in central portion of Watershed near Siphon Reservoir and drains southwesterly.

San Diego Creek Watershed Drainages	Drainage Characteristics
Barranca Channel	Channel originates near MCAS Tustin. Engineered channel draining southeasterly through City of Irvine.
Agua Chinon Wash and Channel	Natural watercourse upstream of SR-241 to headwaters in Limestone Canyon of the Lomas de Santiago foothills. Engineered open channel downstream of SR-241 to I-405 Freeway through former MCAS El Toro and Irvine areas.
Serrano Creek	Natural watercourse upstream of Serrano Road in Lake Forest to its headwaters in Whiting Ranch Wilderness Park (Lomas de Santiago foothills) drains southwesterly. Engineered portion through former MCAS El Toro and cities of Irvine and Lake Forest downstream of Serrano Road to intersection of Irvine Center Drive and Bake Parkway.
Borrego Canyon Wash and Channel	Natural watercourse upstream of Irvine Boulevard to headwaters in Whiting Ranch Wilderness Park of the Lomas de Santiago foothills. Drains southwesterly into Agua Chinon Wash. Engineered portion downstream of Irvine Boulevard, draining former MCAS El Toro, and cities of Irvine and Lake Forest.
Round Canyon Wash	Natural watercourse through undeveloped Orange County. Confluence with Bee Canyon Channel near SR-241.
Bee Canyon	Drainage originates in Lomas de Santiago foothills, and drains southwesterly. Natural watercourse upstream of SR-241, with landfill representing a substantial land disturbance to this canyon wash. Consists of reinforced concrete boxes under MCAS El Toro runways and open channels outside the runway areas. Upstream of Irvine Blvd. excess flows are routed into the Marshburn retarding basin. Engineered portion south of SCRRA railway tracks to I-5.
Canada Channel	Earthen channel through Laguna Hills, Irvine.
Veeh Storm Channel	Earthen channel through Laguna Hills Golf Course in Laguna Hills. Drains into Veeh Reservoir.
Bonita Creek	Drainage originates in the San Joaquin foothills and drains northwesterly into San Diego Creek near Upper Newport Bay.
Laguna Canyon Wash	Canyon wash originates in San Joaquin foothills and drains northerly into San Diego Creek. Most of the wash is in a natural condition with a soft bottom. The wash has been channelized below the canyon areas even in the City of Laguna Beach where a 3-wall channel has been constructed. This channel ends in the downtown area of Laguna Beach where the wash reverts to a natural condition and empties into the Pacific Ocean.
Sand Canyon Wash (includes Bommer and Shady Canyons)	Drainage originates in San Joaquin Hills and drains northwesterly into San Diego Creek near Campus Drive. Consists of reinforced concrete boxes under MCAS El Toro runways and open channels outside the runway areas. Upstream of Irvine Blvd. excess flows are routed into the Marshburn retarding basin. Engineered portion south of SCRRA railway tracks to I-5.
Peters Canyon Sub-Drainage Area	
Peters Canyon Wash	Originates in Peters Canyon Regional Park and drains southerly into San Diego Creek. Partially engineered channel through cities of Irvine and Tustin. Engineered portion is downstream of Peters Canyon Reservoir.
Rattlesnake Canyon	Originates in Lomas de Santiago foothills. Portions upstream of Portola Parkway are both natural watercourse (upper reaches), and unlined channelized portions. Drains southwesterly into Peters Canyon Wash.
Hicks Canyon Wash	Originates in Lomas de Santiago foothills. Portions upstream of Portola Parkway are both natural watercourse (upper reaches) and unlined channelized portions. South of Portola Parkway, drainage is routed underground and flows southwesterly into Peters Canyon Wash.
El Modena-Irvine Channel	Lined channel originating in northern portion of the Watershed in City of Tustin and drains southerly into Peters Canyon Wash.
Santa Fe Channel	Engineered/lined channel. Drainage originates in western portion of the Watershed within cities of Santa Ana and Tustin and drains southeasterly into Peters Canyon Wash.

San Diego Creek Watershed Drainages	Drainage Characteristics
Tustin Channel	Consists of reinforced concrete boxes under MCAS El Toro runways and open channels outside the runway areas. Upstream of Irvine Blvd. excess flows are routed into the Marshburn retarding basin. Engineered portion south of SCRRA railway tracks to I-5.
Como Channel	Engineered channel that originates in central portion of the Watershed and drains westerly into Peters Canyon Wash.
Central Irvine Channel (Trabuco Channel)	Unlined channel through Irvine; extends from Peters Canyon Channel to Jeffery Road, and terminates at the Trabuco Retarding Basin .

Surface Flows

The amount of surface flow generated in the Watershed is directly related to the amount of precipitation, the volume of water from urban and agricultural land uses, and the resulting runoff from potable or reclaimed water usage. The annual average precipitation within the Watershed is approximately 18 inches in the mountains and 13 inches near the coast (Corps 2001).

San Diego Creek drains approximately 85 percent of the Watershed. Fresh water flow volumes vary seasonally. Average daily streamflow data are collected from four gaging stations in the Watershed. Average flows during summer months, originating primarily from landscape and some agricultural runoff, are 1 to 3 cubic feet per second (cfs). In contrast, maximum flows occur during winter storms. For example, storms in December 1997 generated flows up to 43,500 cfs in San Diego Creek as measured at the Campus Drive stream gage. San Diego Creek flow characteristics are summarized in Table 3-11.

Table 3-11. Flow Characteristics of San Diego Creek

Flow Description	Flow (cfs)[1]
Annual Average Base (excludes Flood Events)	20-35
Annual Average	30-90
Winter Base (excludes Flood Events)	<45
Winter Dry Weather	»16
Summer Average Base (excludes Flood Events)	<16
Peak Flood Flows	25,000-43,500

[1]Based on RDMD flow data for San Diego Creek measured at Campus Drive gage.

During dry weather, an average of 5 cfs of surface flow is diverted from San Diego Creek into the five water quality treatment ponds within the San Joaquin Marsh, located just upstream of Campus Drive. The Marsh is a 202-acre water quality treatment facility that consists of a series of lakes, permanent marshes, and riparian wetlands constructed by IRWD to help remove nitrate in San Diego Creek dry weather flows before entering Upper Newport Bay. The water remains in the water quality treatment ponds for approximately two weeks before being discharged back into San Diego Creek.

Floodplains

Floodplains generally include the 100-year flood extent, as shown on Federal Emergency Management Agency (FEMA) maps. The 100-year floodplain corresponds in some cases to Department jurisdiction, and also to the extent of riparian habitat as mapped by Lichvar et al. (2000). This entire floodplain or riparian area was assessed in the LLFA (Smith, 2000).

Flood History

Southern California's history of flooding can be characterized as recurrent but infrequent as understood through records kept by missions and other historical sources. Of these early accounts, floods of 1780, 1825, 1862, 1884, 1891, and 1916 were of major proportion (Corps, 2001).

The flood of 1862 probably was the largest known flood in Orange County; however, the 1916 flood was more destructive because of increased development in the County. There are no records of runoff in the San Diego Creek basin, but historical accounts show flooding on nearby San Juan Creek downstream of what is now I-5 that was more than a mile wide and stretched from bluff to bluff. Additional flooding occurred in 1937/1938 causing severe damage to agricultural and urban areas. A peak discharge of 13,000 cfs was recorded at the "San Juan Creek at La Novia Street Bridge" stream gage on March 2, 1938 which was the fourth highest recorded discharge at that gaging station (Corps, 2001).

Additional flooding from intense storm activity occurred in 1943 and 1969. A peak discharge of 22,400 cfs was recorded on San Juan Creek on February 25, 1969 that is the second largest recorded discharge on San Juan Creek. More recently, the storms of 1994/1995 resulted in extensive flooding to homes, businesses, agriculture land, and roadways in the County. Approximately 50 percent of the total annual rainfall for Orange County occurred in January of 1995 that resulted in the overtopping of 25 flood channels causing severe damage (Corps, 2001).

During the winter of 1997-1998 a series of low-latitude Pacific storms moved into Southern California from the west resulting from strong El Niño atmospheric flow patterns. Three rainfall events in December caused severe property damage resulting in landslides, mudflows and the overtopping of flood management channels. The most sizeable of the three events resulted in a 6-hour maximum rainfall duration of greater than 10,000-year return period for Laguna Beach. Damage from the storm extended from Laguna Beach inland through the city of Lake Forest to the foothill and canyon areas and resulted in the complete closure of the I-5 freeway. During this time, San Diego Creek experienced a peak flow of 43,500 cfs, its highest peak flow for the 1978-2004 period of record. In February 1998, precipitation generally equaled the mean annual precipitation for the entire 12-month period (Corps, 2001).

Flood Management

Flood management facilities within the Watershed are within the Orange County Flood Control District (OCFCD). Orange County Resources and Development Management Department (RDMD) administers the OCFCD and manages its 25 flood management channels and 14 retarding basins within the Watershed through its Flood Control Division. Other facilities within the OCFCD are managed by local cities or private entities. Within the OCFCD, RDMD is responsible for maintaining regional channel reaches where it has right-of-way (either fee title or easements). Local facilities are the responsibility of the RDMD in unincorporated areas, and the City of Irvine within its city limits.

Flood management facilities and flood hazards within the Watershed are controlled and managed by RDMD through implementation of the San Diego Creek Drainage and Flood Control Master Plan (John M. Tettemer and Associates, 1989). The Flood Control Master Plan describes a system of retarding basins, reservoirs, and engineered channels to minimize the potential for flooding impacts in developed areas by conveying stormwater to the Pacific Ocean. Consequently, dry season runoff from urban land uses, landscape irrigation, and agricultural irrigation also flows through the Flood Control Master Plan facilities.

The Flood Control Master Plan analyzed the existing tributary drainage areas of San Diego Creek from its headwaters to I-405 downstream of the confluence with Peters Canyon Channel. The Flood Control Master Plan identified a range of flood risk reduction measures for the Watershed that would manage flood peaks based on a 100-year flood. The Flood Control Master Plan was adopted by the City of Irvine, the City of Tustin, and the County of Orange, and is currently being implemented in phases by these entities.

The Corps Newport Bay Watershed Management Study, Baseline Conditions Report (2001) provides a hydraulic and floodplain analysis of San Diego Creek drainages. According to the Corps analysis, the San Diego Creek drainage system generally has adequate capacity for the 100-year storm event[1]. Flow from the 100-year event or less would mostly be contained within the three major channels analyzed in the study (Peters Canyon Wash, San Diego Creek and Serrano Creek). The 200-year and 500-year events could exceed the channel capacity of these three channels in various locations affecting residential and industrial development. However, according to the Corps study, the remaining planned future development in the Watershed is not expected to add substantial flow increase into the major channels**.**

Geomorphology

The San Diego Creek channel system has undergone considerable natural and man-made changes during the past 75 years, as previously discussed. Nearly all the engineered channel reaches of San Diego Creek and Peters Canyon Wash are trapezoidal earth channels except for the reach from Culver Drive to Jeffrey Road, which is a parabolic-shaped channel with vegetation cover for erosion protection (Corps, 2001). A series of concrete drop structures were constructed along this reach to prevent channel degradation. In the lower reach of San Diego Creek, the channel was further excavated in 1982 and three sediment basins were established for control of sediment loading into Upper Newport Bay, as discussed further in the next section of this document. The Corps generally characterizes these lower modified channels of Peters Canyon Wash and San Diego Creek as geomorphically stable. A geomorphic characterization of some of the canyon washes was not conducted due to lack of data. However, data were available for the Corps to assess Serrano Creek. Serrano Creek has suffered a number of substantial flood events that have resulted in damage to the Creek (Corps, 2001). The Corps geomorphic analysis of various reaches of Serrano Creek and concluded that with the exception of the uppermost reach, the lower reaches of the Creek are unstable generally due to downcutting of the channel and bank erosion from high velocity flows. The City of Lake Forest and the County have been implementing restoration plans to address erosion, flood management, recreation, and landscaping improvements along several portions of the Creek.

Groundwater Hydrology/Recharge

The Watershed overlies a corner of the Orange County coastal groundwater basin referred to as the Irvine Sub-Basin. The Irvine Sub-Basin contains marine sedimentary deposits primarily consisting of layers of clays, silts, and sands. The groundwater is salty, with naturally occurring salts from the original deposition of sediments. Therefore, the groundwater is marginal for drinking water uses and nitrate concentrations in some areas are elevated due to use of agricultural fertilizers.

[1] Use of different hydrologic and hydraulic data and models, or risk management requirements, may lead to results that differ from the Corps study. Consequently, it is expected that divergent conclusions may be reached about the capability of existing facilities to provide the desired flood risk reduction or methods for increasing flood capacity.

The Irvine Sub-Basin is generally recharged by infiltration of runoff, reservoir and basin seepage and from natural stream flow. The sub-basin contains two water bearing zones; a shallow, semi-perched zone and a deeper, alluvial aquifer. The depth to groundwater in the main alluvial aquifer is more than 100 feet below ground surface in the eastern portion of the Watershed, reducing to 10 feet or less below the ground surface in the western portion of the Watershed. Groundwater recharge to the deeper portion of the aquifer generally occurs in the eastern portion of sub-basin, near the foothills of the Santiago Hills where ephemeral streams flow from the Santa Ana Mountains. Groundwater recharge in the western, shallower portion of the aquifer occurs primarily from rainfall and irrigation infiltration (Bonterra, 2003).

3.3.2 Erosion and Sedimentation

Sediment deposition from the Watershed into Upper Newport Bay has been a long-standing concern in the Watershed. Sediment loads to Upper Newport Bay generally result from erosion of open space lands in the foothill areas, grading activities for development, increased runoff and channel erosion due to urbanization and erosion of agricultural lands. Also channelization has increased the quantity and efficiency of freshwater and sediment transport to the Bay from the Watershed. Most deposition occurs during major storm events, although low-level transport occurs -year round. For nearly 20 years, the cities, county, resource agencies and The Irvine Company have been implementing the San Diego Creek Comprehensive Storm Water Sedimentation Control Plan prepared by the Southern California Association of Governments (SCAG) pursuant to Section 208 of the CWA. The “208 Plan” resulted in implementation of agricultural and construction BMPs and resource conservation plans to address erosion at the source. Also, the plan involved capturing remaining sediment in a series of in-channel sediment basins in San Diego Creek, foothill basins, and sediment basins in Upper Newport Bay. These basins are described below in more detail.

In-channel Sediment Basins **-** Three in-channel sediment basins are located within the lower reach of San Diego Creek. These Basins act as sediment “traps” which are designed to retard the flow of water coming through San Diego Creek prior to its discharge into Newport Bay. By slowing the velocity of the water, sediment is able to drop out of suspension and deposit in the basins rather than being carried to the Bay. In-channel Basin 1 is the southernmost basin, located within San Diego Creek between Campus Drive and MacArthur Boulevard, and has a design capacity of 218,000 cubic yards (5,886,000 cubic feet). In-channel Basin 2, located from Campus Drive to about a quarter-mile upstream of the confluence of San Diego Creek and Sand Canyon Channel has a design capacity of 64,000 cubic yards (1,728,000 cubic feet). In-channel Basin 3, is the northernmost basin, located between In-channel Basin 2 and the confluence of San Joaquin Channel and has a design capacity of 91,000 cubic yards (2,457,000 cubic feet) (RDMD, 2003)**.** These in-channel sediment basins are currently maintained by IRWD under a maintenance agreement with OCFCD.

Foothill Retarding Basins **-** The foothill basins are elements of the Flood Control Master Plan for San Diego Creek adopted by the County in 1989 and are also identified in the County’s San Diego Creek Sediment Control Plan (1983). These basins have dual purposes: 1) sediment collection and 2) flood management. The basins are designed to trap substantial amounts of debris, including sediment that could clog downstream channels, create flooding and ultimately be deposited into Upper Newport Bay. These basins also retard discharge by collecting water during a storm and releasing the water afterwards. Characteristics of the Foothill Retarding Basins are shown in the Table 3-12.

Table 3-12. Characteristics of Foothill Retarding Basins

Basin Name	Design Capacity In cubic yards (CY)/ cubic feet (CF)	Maintenance Responsibility
Bee Canyon Basin	62,900/1,698,300	RDMD
Round Canyon Basin	45,200/1,220,400	RDMD
Agua Chinon Basin	64,500/1,741,500	RDMD
Hicks Canyon Basin	29,400793,800	RDMD
East Hicks Canyon Basin	8,100/218,700	RDMD
Orchard Estates Basin	46,000/1,242,000	RDMD

Source: RDMD, 2003.

Valley Retarding Basins. Valley retarding basins and reservoirs are located in the valley areas (Tustin Plain area). The primary purpose of these basins is flood management. These six basins include: Lower Peters Canyon Retarding Basin; Peters Canyon Regional Park Dam; El Modena-Irvine Retarding Basin; Marshburn Retarding Basin; Trabuco Retarding Basin; and Veeh Reservoir.

Although the 208 Plan helped reduce sedimentation to the Bay, erosion problems in some of the main and tributary channels of San Diego Creek remain (Corps, 2001). Sedimentation continues to adversely affect the estuarine species and habitats and navigation channels south of Upper Newport Bay Ecological Reserve. Recent studies in the in the Watershed indicate that engineered basins can accumulate sediment loads during low flow periods, reducing sediment supply to downstream reaches and increasing channel erosion potential. During periods of high flow, the basins can act as sources of sediment load, and previously accumulated deposition can be re-suspended and transported downstream, potentially exacerbating sedimentation problems (Trimble, 2003).

Sediment Monitoring. The RWQCB Monitoring and Reporting Program No. 99-74 requires sediment monitoring and maintenance activities for compliance with the sediment TMDL. The Upstream Monitoring Element applies to those activities performed in the Watershed. The available capacities of the in-channel sediment basins were monitored to evaluate the need for sediment removal. The 2005-06 survey results showed that all in-channel basins had greater than 50 percent available capacity and, therefore, met the minimum requirements established by the TMDL. The Monitoring and Reporting Program requires that foothill retarding basins be surveyed once every five years or in a year when 100 percent of the mean basin rainfall occurs. Based on the 2005-06 season rainfall totals, the rainfall thresholds requiring basin surveys were not met. However, the County conducted spot surveys of the seven foothill sediment control basins (Hicks, East Hicks, Agua Chinon, Bee, Marshburn, Round Canyon and Orchard Estates) to determine the current available capacity. All seven basins had greater than 50 percent available capacity for sediment storage and therefore met the available capacity targets established in the sediment TMDL. Sediment removal activities were conducted in the Bee Canyon and Marshburn foothill basins during the 2005-06 reporting period. Approximately 36,310 cubic yards of sediment were removed from the Bee Canyon foothill basin, resulting in a 58% increase to the available sediment capacity. The Marshburn basin was under reconstruction during the reporting period. Reconstruction efforts included lowering the invert 12 feet and increasing the overall capacity of the basin. (County of Orange, Resources and Development Management Department, Upper Newport Bay/San Diego Creek Watershed Sediment TMDL, 2005-06 Annual Report).

Sediment Transport. Sediment transport is the movement of sedimentary materials either by gravity; running water such as rivers, creeks, and streams; glaciers; wind; and sea currents or longshore drift. For the Watershed, the primary means of sediment transport is through creeks and streams. Orange County has been measuring sediment transport on a daily basis since 1983 at three gage stations. These gage stations include San Diego Creek at Culver Drive, San Diego Creek at Campus Drive, and Peters Canyon Wash at Barranca Parkway. The sediment transport presented in this section is based on the County's field measurement and analysis.

During the 1999-2006 period, the County collected fluvial sediment samples from the sediment stations along San Diego Creek and Peters Canyon Wash. The data show that sediment samples collected from the Campus Drive Station contain a higher percentage of fine material than samples collected at the Peters Canyon Wash and Culver Drive Stations. This suggests that coarser particles are being deposited upstream of the Campus Drive Station in the sediment basins and reaches. Sediment transport curves for San Diego Creek at Campus Drive, Culver Drive, and for Peters Canyon Wash at Barranca Parkway were calculated by the County using a historic database of sediment concentration curves. The transport curves show a relationship between the daily water discharge and the daily sediment discharge. Sediment transport curves for Bonita Canyon, Sand Canyon, Marshburn, and Agua Chinon are being developed and annual sediment discharges will not be available until this is accomplished. For the more recent 2005-06 reporting period, 602 fluvial sediment samples were collected 147 of which were storm samples. In addition, the United States Geological Survey (USGS), through a joint-funding agreement, collected samples at four of the eight stations (Barranca, Culver, Campus and Santa Ana-Delhi) (RDMD, 2006).

Sediment Discharge. In the 2005-06 reporting period, annual sediment discharges were calculated based on sediment concentration curves, sediment transport curves and streamflow data for four stations within the Watershed. The results were as follows:

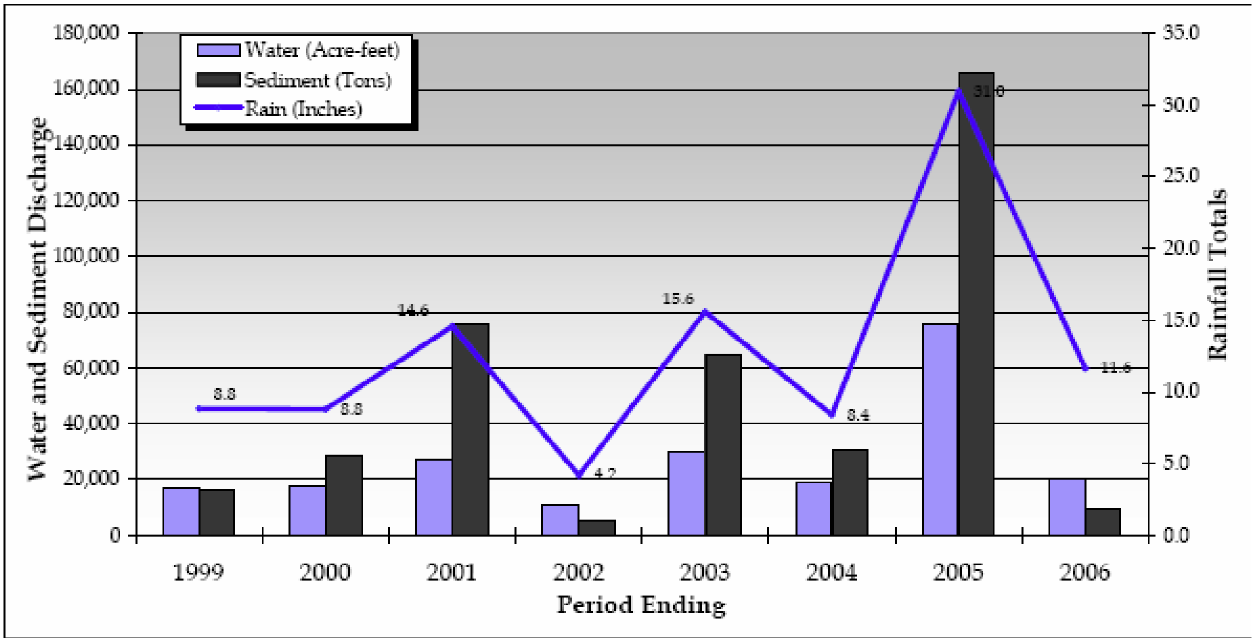
- Peters Canyon Wash at Barranca Parkway (Barranca Station): 2,935 tons;
- San Diego Creek at Culver Drive (Culver Station): 6,919 tons;
- San Diego Creek at Campus Drive (Campus Station): 9,291 tons; and
- Santa Ana-Delhi at Irvine Avenue (Santa Ana-Delhi): 345 tons.

Sediment loading at Campus Drive is important because it is the last sediment monitoring station before San Diego Creek enters Upper Newport Bay. Therefore, it offers the most useful data to measure the amount of fluvial sediment being transported into the Bay from San Diego Creek. For the period 1997-2006, sediment discharge from San Diego Creek as reported by RDMD (2006) is as follows:

1997-98: 618,000 tons	2002-03: 64,740 tons
1998-99: 16,400 tons	2003-04: 30,464 tons
1999-00: 28,900 tons	2004-05: 165,810 tons
2000-01: 75,700 tons	2005-06: 9,291 tons
2001-02: 5,640 tons	

The variation noted in the sediment discharge record correlates well with the annual rainfall variation measured at a local gage (Tustin-Irvine Ranch) over the same period. As indicated in Figure 3-11, this correlation extends over the entire period over which the RDMD has been monitoring sediment discharges on San Diego Creek. The recent four years of record (1999/00-2005/06) are highlighted on this figure to demonstrate the consistency of this trend in the present record.

Figure 3-11. San Diego Creek Sediment and Streamflow Discharge versus Rainfall, San Diego Creek at Campus Drive, 1999 – 2006



3.3.3 Hydrologic Integrity

Hydrologic integrity is defined as the range of frequency, magnitude, and temporal distribution of stream discharge along with a concomitant surface and subsurface interaction with the floodplain that historically characterized riparian ecosystems in the region. In southern California, this translates into seasonal intermittent, ephemeral, or low flow periods, with annual bankfull discharges superimposed on a background of episodic, and often catastrophic, larger magnitude floods that inundate historical terraces.

Indicators used to assess hydrologic integrity included factors that influence the frequency, magnitude, and temporal distribution of stream discharge, and factors that influence the hydrologic linkage between the stream channel and the active floodplain and adjacent terraces, as listed:

- **Altered Hydraulic Conveyance –** a measure of the extent of man-made modifications to drainage channels such as concrete channels;
- **Surface Water Retention –** a measure of the degree to which the hydrologic regime has been altered due to storage in sediment and retention basins;
- **Perennialized Stream Flow –** a measure of the amount of supplemental stream flows, primarily in the summer, due to man-made return flows from irrigation and/or urban runoff;
- **Import, Export, or Diversion of Surface Water** - a measure of the amount of water imported, exported, or diverted from the natural drainage; and

- **Floodplain Interaction –** a measure of the degree to which the stream channel has been disconnected from the adjacent floodplain due to culturally accelerated channel incision, bank protection, and levees.

As discussed in Section 3.1.2, the Corps conducted a hydrologic characterization of drainages throughout the Watershed, as part of the SAMP LLFA (Smith, 2000). The assessment was accomplished by dividing the riparian ecosystem along the project site drainages into assessment units or "riparian reaches" and assessing each riparian reach using a suite of indicators of ecosystem integrity. One of the indicators assessed was hydrologic integrity. Drainages were considered to have high hydrologic integrity if:

- The short and long-term historical patterns of frequency, magnitude, and distribution of stream discharge remain culturally unaltered from the historical reference condition of the region; and
- The interaction between the stream channel, floodplain, and terraces of these drainages through overbank and subsurface flows have similarly remain culturally unaltered from the historical reference condition.

Figure 3-12 shows the hydrologic integrity rankings throughout the Watershed. Dark areas represent high scores where hydrologic integrity is high. Lighter areas represent reaches where hydrologic integrity has been reduced due to man-made disturbances and factors. In general, the lowest hydrologic integrity scores are along creeks where land development has altered the channels and local drainage basins. In reviewing the results, the Corps (Smith, 2000) noted the following general types of impairments that reduced the hydrologic integrity of various riparian reaches:

- Increased low-flows due to irrigation return flows and runoff from developed areas; and
- Land use and channel modifications that have disrupted natural sediment dynamics in the Watershed.

The highest possible score for hydrologic integrity ranking is 30 (darkest). The results showed an integrity range from 6 to 29, with a mean score of 18. A total of 42.7 acres in the Watershed are ranked as having high hydrologic integrity, 85.4 acres are ranked medium quality, and 57.1 acres are ranked low quality.

Most drainages north of the SR-241 (such as upstream reaches of Round Canyon Wash, Agua Chinon Wash, Borrego Canyon Wash, Serrano Creek), and some drainages in the undeveloped San Joaquin foothills have the highest hydrologic integrity scores, while the lowest scores are found in downstream channels including portions of San Diego Creek, Peters Canyon Wash and Veeh Creek. Shady Canyon Creek upstream of Sand Canyon Reservoir was generally characterized as medium to high integrity, while reaches of Sand Canyon Wash downstream of the reservoir were characterized as medium integrity.

3.4 WATER QUALITY

3.4.1 Surface Water Quality

The Watershed is within the jurisdiction of the Santa Ana RWQCB and is subject to the provisions of the Santa Ana River Basin Water Quality Control Plan (Basin Plan) which identifies the water quality objectives and beneficial uses for waters within its jurisdiction. Table 3-13 shows the present and potential beneficial uses for San Diego Creek and Upper Newport Bay as specified in the Basin Plan. Table 3-14 shows present and potential beneficial uses for other water bodies in the Watershed including the San Joaquin Marsh, lakes/reservoirs, and groundwater sub-basins.

Water quality objectives identified in the Basin Plan are based on the established beneficial uses, and are defined as “the limits or levels of water quality constituents or characteristics, which are established for the reasonable protection of beneficial uses.” In addition, U.S. EPA established numeric water quality criteria for toxic substances in certain designated Receiving Waters of California based on beneficial uses relating to aquatic life or human health. This is known as the California Toxics Rule (CTR) (40 CFR §131.38). The SWRCB adopted a State Implementation Plan (SIP) for the CTR. The CTR criteria do not apply to storm water discharges; instead, those discharges are regulated through various NPDES storm water permits. Applicable numeric water quality objectives for surface water as well as the CTR standards are shown in Table 3-15. Applicable numeric water quality objectives for groundwater are shown in Table 3-16. The Basin Plan also references California Drinking Water Standards as additional objectives that are sometimes applied to surface and groundwater.

San Diego Creek (Reaches 1, 2, and 4) and Newport Bay (Upper and Lower) have been determined to be impaired by the State Water Resources Control Board (SWRCB) and included on the State’s 2006 303(d) list of impaired water bodies since they do not meet established water quality standards as discussed later in this section. (The list is periodically updated). These water bodies are considered impaired from, pathogens (fecal coliform), toxics (dichlorodiphenyltrichloroethane (DDT), chlordane, PCBs, and toxaphene), salinity/total dissolved solids/chlorides, sediment toxicity as well as some metals (copper, and selenium). These contaminants have impacted San Diego Creek and Newport Bay in the form of excessive sedimentation, eutrophication, bacterial contamination, and toxic contamination.

The County of Orange regularly monitors surface water quality in San Diego Creek and Newport Bay including many of the constituents for which these water bodies are impaired. Table 3-17 provides a summary of San Diego Creek and Upper Newport Bay water quality data for dry and wet weather from the County’s 2001/2002, 2002/2003, and 2003/2004 annual monitoring reports.

Figure 3-12. Spatial Distribution of Ecosystem Integrity Scores, Hydrology

Table 3-13. Present or Potential Beneficial Uses of San Diego Creek and Upper Newport Bay

Beneficial Use	San Diego Creek[1]	Upper Newport Bay
Municipal and Domestic Supply (MUN) – includes waters used for community, military, municipal or individual water supply systems. These uses may include but are not limited to drinking water supply.	X[2]	
Groundwater Recharge (GWR) – includes the uses of waters for natural or artificial recharge of groundwater for purposes that may include, but are not limited to future extraction, maintaining water quality or halting salt water intrusion into freshwater aquifers.	X	
Water Contact Recreation (REC-1) – includes the uses of waters for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses may include, but are not limited to, swimming, washing, water-skiing, skin and scuba diving, surfing whitewater activities, fishing, and use of natural hotsprings.	X[3]	X
Non-Contact Water Recreation (REC–2) – includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.	X	X
Commercial and Sport fishing (COMM) – includes uses of waters for commercial or recreational collection of fish or other organism, including those collected for bait. These uses may include, but are not limited to uses involving organism intended for human consumption.		X
Warm Freshwater Habitat (WARM) – includes uses of water that support warm water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.	X	
Preservation of Biological Habitats of Special Significance (BIOL) – includes uses of water that support designated areas or habitats, including but not limited to, established refuges, parks, sanctuaries, ecological reserves or preserves, and Areas of Special Biological Significance, where the preservation and enhancement of natural resources requires special protection.		X
Wildlife Habitat (WILD) – includes uses of water that support terrestrial ecosystems, including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.	X	X
Rare, Threatened, or Endangered Species (RARE) – includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.	X[4]	X
Spawning, Reproduction, and Development (SPWN) – includes uses for supporting a high quality aquatic habitats necessary for reproduction and early development of fish and wildlife.		X
Marine Habitat (MAR) – includes use of waters that support of marine ecosystems that include, but are not limited to preservation and enhancement of Marine habitats vegetation (e.g., kelp beds), fish and shellfish, and wildlife (e.g., marine mammals and shorebirds).		X
Shellfish Harvesting (SHEL) – includes uses of waters that support habitats necessary for shellfish (e.g., clams, oysters, limpets, abalone, shrimp, crab, lobster, sea urchins, and mussels) collected for human consumption, commercial or sports purposes.		X
Estuarine Habitat (EST) – includes uses of water that support estuarine ecosystems, which may include, but are not limited to, preservation and enhancement of estuarine habitats, vegetation, fish and shellfish, and wildlife, such as waterfowl, shorebirds, and marine mammals.	X[5]	X

1 For areas of San Diego Creek upstream of Jeffrey Road to headwaters, applicable beneficial uses are intermittent only, meaning that water conditions do not allow the beneficial use to exist year-round. Intermittent beneficial uses also apply to tributaries of San Diego Creek including Bonita Creek, Serrano Creek, Peters Canyon Wash, Hicks Canyon Wash, Bee Canyon Wash, Borrego Canyon Wash, Agua Chinon Wash, Laguna Canyon Wash, Rattlesnake Canyon Wash, Sand Canyon Wash, and other tributaries to these creeks. The RWQCB is considering listing Peters Canyon Wash individually and assigning its own beneficial uses (RWQCB 2002 Triennial Basin Plan Review).

2 Water body has been specifically excepted from the MUN designation in accordance with the criteria specified in the "Sources of Drinking Water Policy".

3 For reaches below Jeffrey Road, access is prohibited in all or part by County RDMD.

4 The RWQCB is considering adding the RARE beneficial use designation to all reaches of San Diego Creek (RWQCB 2006 Triennial Review of Basin Plan.

5 The RWQCB is considering designating San Diego Creek from Upper Newport Bay mean high tide to drop structure upstream of MacArthur Boulevard as a separate reach (Reach 1A) and adding the EST designation (RWQCB 2006 Triennial Review of Basin Plan).

Table 3-14. Present or Potential Beneficial Uses of Other Water Bodies in San Diego Creek Watershed

Beneficial Use	San Joaquin Marsh	Lakes and Reservoirs[1]	Groundwater Subbasins[2]
Municipal and Domestic Supply (MUN) – includes waters used for community, military, municipal or individual water supply systems. These uses may include, but are not limited to, drinking water supply.		X[3]	X
Agricultural Supply (AGR) – includes waters used for farming, horticulture or ranching. These uses may include, but are not limited to, irrigation, stock watering and support of vegetation for range grazing.		X	X
Industrial Service Supply (IND) – includes waters used for industrial activities that do not depend primarily on water quality. These uses may include, but are not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.			X
Industrial Process Water (PROC) – includes waters used for industrial activities that depend primarily on water quality. These uses may include, but are not limited to, process water supply and all uses of water related to product manufacture or food preparation.			X
Water Contact Recreation (REC-1) – includes the uses of waters for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses may include, but are not limited to, swimming, washing, water-skiing, skin and scuba diving, surfing whitewater activities, fishing, and use of natural hotsprings.	X	X[4]	
Non-Contact Water Recreation (REC–2) – includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.	X	X	
Warm Freshwater Habitat (WARM) – includes uses of water that support warm water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.	X	X	
Preservation of Biological Habitats of Special Significance (BIOL) – includes uses of water that support designated areas or habitats, including but not limited to, established refuges, parks, sanctuaries, ecological reserves or preserves, and Areas of Special Biological Significance, where the preservation and enhancement of natural resources requires special protection.	X		
Wildlife Habitat (WILD) – includes uses of water that support terrestrial ecosystems, including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.	X	X	
Rare, Threatened, or Endangered Species (RARE) – includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.	X		

[1] Includes Laguna, Lambert, Peters Canyon, Rattlesnake, Sand Canyon and Siphon Reservoirs.
[2] Includes Irvine Forebay I, Irvine Forebay II, and Irvine Pressure Zone.
[3]Water body has been specifically excepted from the MUN designation in accordance with the criteria specified in the "Sources of Drinking Water Policy". However, the U.S. EPA reserved action on a previous Basin Plan amendment that excepted a number of water bodies from the MUN beneficial use. These include several waters that are currently used exclusively for storage of agricultural irrigation water: Laguna Reservoir, Lambert Reservoir, Peters Canyon Reservoir and Siphon Reservoir. Issue no. 14 of the 2006 Triennial Review Priority List specifies removal of Laguna and Lambert Reservoirs from Lakes and Reservoirs section of Table 3-1, Beneficial Uses and Table 4-1, Water Quality Objectives of the Basin Plan.
[4] Access prohibited by The Irvine Company.

Table 3-15. Water Quality Objectives and CTR Standards Applicable to Surface Water

Constituent	Units	Basin Plan Objectives [a]	California Toxics Rule [a,b]	
			(CMC)[c]	(CCC)[d]
Inorganic Chemicals				
Aluminum	mg/L	--	--	--
Antimony	mg/L	--	--	--
Arsenic	mg/L	--	0.34	0.15
Asbestos	MFL	--	--	--
Barium	mg/L	--	--	--
Beryllium	mg/L	--	--	--
Boron	mg/L	0.75	--	--
Cadmium	mg/L	--	0.0043	0.0022
Chromium	mg/L	--	0.016	0.011
Chloride	mg/L	--	--	--
Copper	mg/L	--	0.013	0.009
Cyanide	mg/L	--	--	--
Fluoride	mg/L	San Diego Creek 1.2- 0.7 (depending on air temp.) Upper Newport Bay	--	--
Iron	mg/L	---	--	--
Lead	mg/L	--	0.065	0.0025
Manganese	mg/L	---	--	--
Mercury	mg/L	--	--	--
Nickel	mg/L	--	0.47	0.52
Nitrate+Nitrite (as N)	mg/L	-- [b]	--	--
Nitrite (as N)	mg/L	--	--	--
Selenium	mg/L	--	--	0.005
Silver	mg/L	--	0.0034	--
Sodium	%	--	--	--
Sulfate	mg/L	--	--	--
Thallium	mg/L	--	--	--
Zinc	mg/L	--	0.12	0.12
Others				
Ammonia (as N)[e]	mg/L	San Diego Creek Table 4-2 of Basin Plan	--	--
Chlorine, Residual	mg/L	0.1	--	--
Chemical Oxygen Demand (COD)	mg/L	San Diego Creek Reach 1: 90 Reach 2: --- Upper Newport Bay		
Fecal coliform bacteria	Organisms/ 100mL	San Diego Creek MUN: < 100 REC-1: < 200 REC-2: < 2000 Upper Newport Bay REC-1: < 200 SHEL: 14 MPN	--	--
pH	pH Units	San Diego Creek 6.5-8.5 Upper Newport Bay 7.0-8.6	--	--
Specific Conductance	(µs)	--	--	--
Temperature	°F	San Diego Creek	--	--

Constituent	Units	Basin Plan Objectives [a]	California Toxics Rule [a,b]	
			(CMC)[c]	(CCC)[d]
		< 90 June through Oct < 78 Nov through May		
Total dissolved solids (TDS)	mg/L	San Diego Creek Reach 1: 1500 Reach 2: 720 Upper Newport Bay	--	--
Total Inorganic Nitrogen (TIN)	mg/L	San Diego Creek Reach 1: 13 Reach 2: 5 Upper Newport Bay	---	---
Turbidity	NTU	0-50 NTU: max. incr. 20% 50-100 NTU: max. incr. 10 NTU > 100 NTU: max. incr. 10%	---	---

[a] California Toxics Rule (CTR) freshwater aquatic life criteria.

[b] Certain CTR criteria (e.g., copper, lead, zinc) are hardness dependent and can vary depending on the hardness of the receiving water at a given time.

[c] Criteria Maximum Concentration (CMC) equals the highest concentration to which aquatic life can be exposed for a short period of time not to be exceeded more than once every three years on average.

[d] Criteria Continuous Concentration (CCC) equals the highest concentration to which aquatic life can be exposed for an extended (4-days) period of time not to be exceeded more than once every three years on average.

[e] Un-ionized ammonia is toxic to fish and other aquatic organisms.

Source: Santa Ana River Basin Water Quality Control Plan, 1995; California Toxics Rule, May 2000.

Table 3-16. Water Quality Objectives Applicable to Groundwater

Constituent	Units	Basin Plan Objectives
Inorganic Chemicals		
Aluminum	mg/L	--
Antimony	mg/L	--
Arsenic	mg/L	0.05[a]
Asbestos	MFL	--
Barium	mg/L	1.0[a]
Beryllium	mg/L	--
Boron	mg/L	0.75
Cadmium	mg/L	0.01[a]
Chromium	mg/L	0.05[a]
Chloride	mg/L	150
Cobalt	mg/L	0.2[a]
Copper	mg/L	1.0[a]
Cyanide	mg/L	0.2[a]
Fluoride	mg/L	1.0[a]
Iron	mg/L	0.3[a]
Lead	mg/L	0.05[a]
Manganese	mg/L	0.05[a]
Mercury	mg/L	0.002[a]
Nickel	mg/L	--
Nitrate (NO_3)	mg/L	--
Nitrate+Nitrite (as N)	mg/L	8,6,6[c]
Nitrite (as N)	mg/L	--
Selenium	mg/L	0.01[a]
Silver	mg/L	0.05[a]

Constituent	Units	Basin Plan Objectives
Sodium	%	180,100,100[c]
Sulfate	mg/L	340,240,240[c]
Thallium	mg/L	--
Zinc	mg/L	--
Others		
Bacteria, Coliform	Organisms/100 mL	2.2[a]
Color	Color Units	--[b]
Hardness	mg/L	450,380,380[c]
Methylene Blue-Activated Substances (MBAS)	mg/L	0.05[a]
Odor	Units	--[e]
Oil and Grease		--[d]
PH	pH Units	6-9
Radioactivity:		
Combined Radium-226 & Radium-228	PCi/L	5[b]
Grass Alpha particle activity	PCi/L	15[a]
Tritium	PCi/L	20,000[a]
Strontium-90	PCi/L	8[a]
Gross Beta particle activity	PCi/L	50[a]
Uranium	PCi/L	20[a]
Specific Conductance	(µs)	--
Total dissolved solids	mg/L	1000,720,720[c]
Toxic Substances		**--[f]**
Others		
Turbidity	NTU	--

a In groundwaters designated MUN.

b Shall not result in coloration of the Receiving Waters which causes a nuisance or adversely affects beneficial uses.

c Irvine Forebay I, Irvine Forebay II, and Irvine Pressure, respectively.

d Shall not result in deposition of oil, grease, wax or other materials in concentrations which cause nuisance or adversely affect beneficial uses.

e Shall not contain taste or odor-producing substances at concentrations which cause a nuisance or adversely affect beneficial uses.

f Shall be maintained free of substances in concentrations toxic or physiologically detrimental to human, plant, animal or aquatic life.

Table 3-17. San Diego Creek and Upper Newport Bay Water Quality Monitoring Data

Water Quality Constituent	Units	County of Orange 2002/2003 Program Effectiveness Assessment Data				County of Orange 2003/2004 Program Effectiveness Assessment Data				County of Orange 2004/2005 Program Effectiveness Assessment Data			
		San Diego Creek at Campus Drive		Upper Newport Bay, Unit I in-bay basin		San Diego Creek at Campus Drive		Upper Newport Bay, Unit I in-bay basin		San Diego Creek at Campus Drive		Upper Newport Bay, Unit I in-bay basin	
		Dry Season Avg.	Wet Season Avg.	Dry Season Avg.	Wet Season Avg.	Dry Season Avg.	Wet Season Avg.	Dry Season Avg.	Wet Seaso n Avg.	Dry Season Avg.	Wet Season Avg.	Dry Season Avg.	Wet Season Avg.
Inorganic Chemicals													
Cadmium	Ug/L	<1.05	<1.04	--	<1.2	<1	<5.2	--	<1	<1	<0.72	<1.1	<0.7
Copper	Ug/L	<10.5	<12.2	--	<6.9	19.5	<15.4	--	9.1	7.8	<7.0	13.4	<7.3
Lead	Ug/L	<2.3	<2.8	--	<1.9	<2.2	<2.6	--	<2.4	<2.1	<2.2	<3.6	<2.4
Nitrate as NO_3	Mg/L	11.1	23.3	<0.6	3.8	10.6	25.0	<0.5	<2.5	<7.5	<28.3	<0.75	<4.6
$NH_{3/}N$	Mg/L	<0.1	<0.1	<0.2	<0.2	<0.1	<0.09	0.2	<0.2	<1.5	<0.09	<0.09	<0.21
NH_4/N	Mg/L	--	--	--	--	--	--	--	--	--	--	--	--
TKN	Mg/L	1.8	2.0	0.7	0.8	2.4	1.9	0.6	0.8	2.2	1.4	0.66	1.1
Phosphorous (Total Phosphate as PO_4)	Mg/L	0.6	1.0	0.4	0.7	0.4	0.7	0.4	0.6	0.5	1.7	0.41	1.2
Ortho Phosphate as P	mg/L	<0.02	<0.2	0.09	0.2	<0.02	<0.09	0.1	0.1	<.05	<0.17	6.6	<0.2
Selenium	ug/L	<22.2	<19.1	--	3.6	15	<6.4	--	--	<13.8	<14.6	--	--
Zinc	ug/L	<19.9	<30.6	--	<20.8	<29.0	<28.7	--	32.3	<20.5	<24.1	<35.8	<29.3
Others													
Sediment	Sediment monitoring data are provided in Section 3.3.2 of this EIS/EIR. Sediment chemistry data are available in the County of Orange 2002/2003 Annual Report and can be found at http://www.ocWatersheds.com/StormWater/documents_damp_pea.asp												
Toxics													
Diazinon	ng/L	<50	<51.8	--	--	<5	<30.86	--	--	<6.3	<218.4	--	--
Chlorpyrifos	ng/L	<50	<20.4	--	--	<5	<5	--	--	<5	<219.6	--	--

3.4.2 Total Maximum Daily Loads (TMDLs)

To address the water quality impairments of San Diego Creek and Newport Bay, Total Maximum Daily Loads (TMDLs) have been adopted by the RWQCB. TMDLs set seasonal loading targets of a constituent for dischargers to both San Diego Creek and Newport Bay. TMDLs have been adopted for nutrients (total nitrogen and total phosphorus); sediment; and pathogens using fecal coliform as a pathogen indicator, diazinon and chlorpyrifos. Technical TMDLs for toxic substances including dissolved metals (cadmium, copper, lead, zinc), selenium, organochlorines [DDT, chlordane, dieldrin, polychlorinated biphenyls (PCBs), toxaphene] were promulgated by U.S. EPA. The RWQCB is working on Basin Plan amendments to incorporate these toxic substance TMDLs.

Implementation of the TMDLs is intended to help achieve the water quality objectives listed in Table 3-15. At this time and in accordance with the phased TMDL implementation program, regulatory agencies, local governments, and private entities are conducting monitoring studies to determine how to attain the TMDL objectives. Table 3-18 contains details of the TMDLs.

Table 3-18. TMDLs Applicable to Newport Bay and San Diego Creek

Sediment	Nutrients	Pathogens	Toxics
General Information and Target Reductions			
1998 estimate: 250,000 tons deposited/yr Reduction: 50% (to 125,000 tons/yr) within 10 years (2008)	1998 estimate: 1,087,000 lbs/yr. Predominant sources: commercial nursery and agricultural land tailwaters Reduction: 50% by 2012	Fecal coliform bacteria used as indicator. Reduction: less than 200 organisms/100 ml. No more than 10% of samples to exceed 400 organisms/100 ml for any 30-day period.	Problem toxic substances: PCBs, DDT, chlordane, dieldrin, diazinon, chlorpyrifos, toxaphene, copper, cadmium, lead, zinc, and selenium (occurs naturally).
Allocations			
62,500 tons to Newport Bay. 62,500 tons to rest of the Watershed. Load allocations (total 10 yr. Running annual avg. (in tons/yr): Open space = 28,000 Agriculture = 19,000 Construction = 3,000 Urban = 2,500	Loading targets for seasonal and annual amounts of total nitrogen and phosphorus, with 5, 10, and 15-year target dates. Waste & load allocations for total nitrogen (5-year target) (in lbs/season): Nursery = 67,344 Silverado Constr. = 25,671 Urban = 20,785 Agricultural = 22,963 Open space/natural = 63,334 Waste & load allocations for total phosphorous (5-year target) (in lbs/yr): Urban = 4,102 Construction = 7,947 Agricultural = 26,196 Open space = 38,640	Waste & load allocations (14 yr. Target date): Urban runoff (incl. Storm water), agricultural runoff (incl. Storm water), and natural sources = 5-day sample/30-day geometric means of less than 200 organisms/100 ml, no more than 10% of samples to exceed 400 organisms/ 100 ml for any 30-day period. Vessel waste = 0.	PCB to San Diego Creek: 282.1 g/yr DDT to San Diego Creek: 432.6 g/yr Chlordane: 314.7 g/yr Dieldrin: 262.0 g/yr Diazinon: Acute: 80 ng/L Chronic: 50 ng/L Chlorpyrifos: Acute 20 ng/L Chronic 14 ng/L Toxaphene: 8.9 g/yr Copper to Newport Bay: 11,646 lbs/yr Cadmium: 14,753 lbs/yr Lead: 27,136 lbs/yr Zinc: 285,340 lbs/yr Selenium to San Diego Creek: 891.4 ug/L

Table 3-18. TMDLs Applicable to Newport Bay and San Diego Creek (continued)

Sediment	Nutrients	Pathogens	Toxics
Implementation			
Monitoring and surveys conducted by the County, and cities of Irvine, Tustin, Lake Forest, Costa Mesa, Santa Ana, and Newport Beach with the financial participation of The Irvine Company. Maintenance of basins to performance standards and other requirements.	Agricultural Nutrient Management approved by RWQCB identifies management measures and guidance practices. Based upon monitoring studies, RWQCB will review and may revise the current nitrogen objective for San Diego Creek in the Basin Plan.	Monitoring plans resulting from studies conducted by County Health Care Agency. Monitoring study to determine appropriateness of current bacteria objectives and reduction target.	Diazinon and Chlorpyrifos: Phase out household use. DDT and PCBs: State conduct investigations of potential spill sites to identify hotspots and remedial action. Selenium: monitor flow, discharge management practices. Copper: reduce through five areas of action.

Following is description of each water quality impairment and how the TMDL is addressing the impairment.

Sedimentation: Erosion in the Newport Bay Watershed and resultant sediment deposition in the Bay is a continual threat to the beneficial uses of the Bay. Most deposition occurs during major storm events and can originate from construction activities, channel erosion, and erosion of agricultural land and open space. The sediment TMDL adopted by the RWQCB in 1998 requires implementation of sediment control measures to ensure that sediment discharges to Newport Bay will not substantially change the existing acreage of aquatic, wildlife, and rare and endangered species habitat, and maintain the navigational and non-contact recreational uses of the Bay (RWQCB, 2004).

The major elements of the sediment TMDL are:

- Maintain both the Unit III and Unit II sediment control basins in Upper Newport Bay to a minimum depth of 7 feet below mean sea level.
- Ensure that sediment control measures to protect the habitat in Newport Bay does not allow more than a one percent change from existing acreage.
- Reduce the annual average sediment load in the Watershed from a total of approximately 250,000 tons per year to 125,000 tons per year within 10 years (i.e., 2008), thereby reducing the sediment load to Newport Bay to approximately 62,500 tons per year. It is assumed that the rest of the material would be trapped in the Watershed basins.
- Implement sediment control measures in Upper Newport Bay such that the basins need not be dredged more frequently that about once every 10 years, and the long-term goal of reducing the frequency of dredging to once every 20 to 30 years.
- All Watershed in-channel and foothill sediment control basins shall be maintained to have at least 50 percent design capacity available prior to November 15 of each year[2].

Other aspects of the sediment TMDL include a monitoring program and a requirement to prepare topographic and vegetation surveys of Upper Newport Bay every three years. Additional details about sedimentation and sediment discharge are discussed in Section 3.3.2.

[2] Sediment removal in the in-channel and foothill sediment control basins is a County of Orange project regulated under CWA Section 404 and FGC Section 1600 *et seq.*

Eutrophication: Newport Bay has exhibited signs of nutrient enrichment for over 25 years. Nutrient enrichment and resulting algae growth adversely impact the beneficial uses of the Bay. In addition, existing numeric water quality objectives for total inorganic nitrogen in San Diego Creek were not being achieved. These factors prompted development of the nutrient TMDL for the Newport Bay Watershed in 1998 (RWQCB, 2004). The TMDL identifies tailwaters from commercial nurseries and agricultural lands as the predominant sources of nutrients, but recognizes the substantial reductions in nutrient loads over the years, primarily due to the introduction of drip irrigation systems and/or recycle systems. The TMDL states that these improvements coupled with the increased tidal flushing caused by the construction of the in-Bay basins appear to have resulted in a substantial downward trend in nitrate concentrations in the Bay. However, since algae blooms are still occurring in Newport Bay and San Diego Creek, they are listed as water quality impaired due to nutrients pursuant to Section 303(d) of the CWA.

The nutrient TMDL provides loading targets and compliance schedules for seasonal and annual amounts of total nitrogen and phosphorus. The nutrient load reduction targets are incorporated into Waste Discharge Requirements (WDRs) as effluent limits, load allocations, and wasteload allocations to ensure that the total inorganic nitrogen for the Bay and Watershed are achieved, and the CWA requirements for the implementation of the TMDL are satisfied (RWQCB, 1998). The primary reduction of phosphorous loading is expected to be achieved by implementation of the Sediment TMDL for the Newport Bay/San Diego Creek Watershed, since much of the phosphorus loading to the Bay occurs via soil particle transport to the Bay (RWQCB, 2000, 2002). IRWD's ongoing Natural Treatment System (NTS) project, is a watershed-wide network of constructed wetlands, designed to treat dry weather flows as well as runoff from smaller, more frequent storms, in response to nutrient loading throughout the Watershed and TMDL limits for total nitrogen and total phosphorus.

Monitoring results from the past few years indicate substantial progress toward compliance with the TMDL some of which can be attributed to the implementation and effectiveness of BMPs in the Watershed. There have also been substantial nitrogen load reductions resulting from IRWD's diversion of a portion of San Diego Creek flows through wetlands ponds at the San Joaquin Marsh (RWQCB, 2000). Also, under the Agricultural Nutrient Management Program prepared by the University of California Cooperative Extension (UCCE) and approved by the RWQCB in 1999, BMPs have been implemented to improve agricultural operations and reduce nutrient loads from agricultural runoff.

As part of the 2002 Triennial Review, the RWQCB reviewed the nutrient TMDL and concluded the following:

- TMDL-required nutrient loading reductions have been largely achieved;
- Considerable progress is evident in reducing the extent of macroalgal blooms in Newport Bay;
- Water quality objectives are still not fully achieved (fall blooms still continue in Upper Newport Bay); and
- TMDL allocations need to be revised downward to ensure Newport Bay becomes free of macroalgal blooms.

Based on the above conclusions, the RWQCB intends to complete studies necessary to revise the water quality objectives in San Diego Creek for nutrients, sediment and dissolved oxygen; develop revised (lower) TMDL allocations; and continue to support nitrogen reduction efforts including: 1) finalized/revised NPDES permits and WDRs; 2) reductions in urban nutrient loading; and 3) IRWD's NTS Program**.** As part of the 2006 Triennial Review and pursuant to the Newport Bay/San Diego Creek Watershed nutrient TMDL implementation plan, the RWQCB is conducting studies to consider revised nutrient objectives. The results of these investigations will be used to develop specific recommendations for changes to the nutrient objectives.

Bacterial Contamination: Bacterial objectives established to protect the beneficial uses of Newport Bay have rarely been achieved. Because of consistently high levels of total coliform bacteria, the upper portion of Upper Newport Bay has been closed to water-contact recreation, while shellfish harvesting has been prohibited in the entire Upper Bay since 1978. A prioritized, phased approach to the control of bacterial quality in the Bay is specified in the pathogen TMDL, adopted by the RWQCB in 1999. The phased approach is intended to allow for additional monitoring and assessment to address areas of uncertainty and for future revision and refinement of the TMDL as warranted by these studies (RWQCB, 2004).

The pathogen TMDL addresses bacterial contamination of the Newport Bay. The two beneficial uses that can be affected are water-contact recreation and shellfish harvesting. The pathogen TMDL applies waste load allocations for fecal coliform (pathogen indicator) for urban runoff, including storm water and vessel waste. Initial work efforts are directed towards monitoring and assessment of existing conditions. It is expected that implementation of IRWD's NTS program will help control fecal coliform levels in the Watershed, helping to meet the pathogen TMDL.

Toxic Substance Contamination: Toxic substances such as pesticides, metals, and organics are present in the Watershed and Newport Bay at concentrations that adversely impact attainment of water quality standards. In January 2001, the RWQCB published a document that reviewed available chemistry data from water column samples, sediment, fish, and shellfish tissue, and water column toxicity tests to identify the substances that were causing water quality impairments. More recently, U.S. EPA conducted its own evaluation of the data and has formulated technical TMDLs for a list of chemicals (See Table 3-18). The RWQCB has amended the Basin Plan to incorporate TMDLs for nutrients, sediment, fecal coliform, chlorpyrifos and diazinon. In addition, the RWQCB is currently considering the adoption of a Basin Plan amendment to incorporate organochlorine compounds TMDLs for San Diego Creek and Upper and Lower Newport Bay. Basin Plan amendments for the other toxics contained in U.S. EPA's technical TMDLs are forthcoming from the RWQCB. It is expected that IRWD's NTS program will help reduce total copper, lead, zinc and selenium in storm water runoff to San Diego Creek and Newport Bay. Along with other Watershed efforts, the NTS program would help toward meeting future TMDLs for metals.

3.4.3 NPDES Storm Water Permits, Drainage Area Management Plan and Local Implementation Plans

The RWQCB regulates discharges of storm water under NPDES storm water permits. Storm water discharges from construction activities disturbing one acre or more of soil are regulated by the SWRCB under the General Permit for Storm Water Discharges Associated with Construction Activities (99-08-DWQ) (General Construction Permit). The General Construction Permit requires implementation of a Storm Water Pollution Prevention Plan (SWPPP) that specifies BMPs to reduce or eliminate sediment and other construction material pollutants in storm water and non–storm water discharges from the construction site. BMPs implemented under the General Construction Permit must meet the technology standards of Best Available Technology Economically Achievable and Best Conventional Pollutant Control Technology. Under the General Construction Permit, the SWPPP must describe the anticipated construction activities and potential pollutants, select BMPs to control the anticipate pollutants (including sediment and erosion controls as well as material management controls), establish processes for inspection and maintenance of BMPs, and include reporting provisions. Per the General Construction Permit, the SWPPP for any project must be designed and implemented such that discharges from construction sites do not to cause or contribute to exceedances of Receiving Water quality standards.

Beginning in 1990, the County of Orange, the OCFCD and the central and northern incorporated cities in Orange County collectively received NPDES Permit No. CAS618030 Permit (MS4 Permit) for storm water discharges into the MS4 within the jurisdiction of the Santa Ana RWQCB. The MS4 Permit was re-issued in 1996 and again in 2002. In July 2006, in compliance with their current permit, the permittees filed a Report of Waste Discharge (ROWD). Adoption of the 4th Term Permit is pending. The MS4 Permit requires implementation of storm water management practices, control techniques, system design and engineering methods to protect beneficial uses of Receiving Waters to the maximum extent practicable. The MS4 Permit governs storm water and urban runoff discharged into the MS4 operated by the County and cities and provides conditional approval of certain non-storm waters to be discharged through the MS4 as long as such discharges are not identified as a significant source of pollutants. Examples of some of these non-prohibited non-storm waters include irrigation waters, passive footing or foundation drains, potable water line flushing, air conditioning condensate, and non-commercial vehicle washing.

The Orange County Drainage Area Management Plan (DAMP) describes the programs and activities that are implemented by the County and the cities for compliance with the MS4 Permit. The County and cities have developed Local Implementation Plans (LIPs) for implementation of the DAMP program elements within their respective jurisdictions. One program element of the DAMP, as required by the MS4 Permit, is to minimize the short- and long-term impacts on Receiving Water quality from new development and significant redevelopment[3]. Under this program element, Water Quality Management Plans (WQMPs) that meet specific criteria of the MS4 Permit, DAMP and LIPs to minimize the effects of development on site hydrology, runoff flow rate and velocities, and pollutant loads to the maximum extent practicable must be prepared for new development and significant redevelopment projects. The WQMP for a new development or significant redevelopment project must incorporate a variety of post-development BMPs that collectively address pollutants of concern and hydrologic conditions of concern for the project's storm water runoff. The four categories of BMPs that can be incorporated into a proposed project as specified in the Model WQMP developed by the County and the cities include: 1) site

[3] New Development is defined as land disturbing activities; structural development, including construction or installation of a building or structure, the creation of impervious surfaces; and land subdivision. Significant Redevelopment is defined as the addition of 5,000 or more square feet of impervious surface on an already developed site.

design BMPs; 2) routine non-structural source control BMPs; 3) routine structural source control BMPs; and 4) treatment control BMPs. As required by the MS4 Permit, the DAMP/LIPs require that new development and significant redevelopment projects must meet specific volume-based and/or flow-based numerical sizing criteria for treating storm water runoff.

Both the MS4 Permit and the Model WQMP encourage the use of regional or Watershed management programs to address runoff from new development and significant redevelopment. Participation in RWQCB-approved regional treatment systems, such as IRWD's NTS program, can fulfill the treatment control requirements of the DAMP/LIPs.

The DAMP/LIPs also contain programs governing private and public construction and utility maintenance projects. These programs mandate implementation of certain pollutant management practices in addition to those requirements imposed by the General Construction Permit. These programs also establish municipal inspection and reporting programs for construction projects.

3.4.4 General NPDES Permit/Waste Discharge Requirements for Short-Term Groundwater Discharges and De Minimus Wastewater Discharges

The RWQCB's Order No. R8-2004-0021 is a General Permit for short-term groundwater discharges and *de minimus* wastewater discharges to surface waters within the San Diego Creek/Newport Bay Watershed. This General Permit covers:

- Short term (one year or less duration) discharges from activities involving groundwater extraction and discharge such as wastes associated with well installation, development, test pumping and purging; aquifer testing wastes; dewatering wastes from subterranean seepage; and groundwater dewatering wastes at construction sites; and
- Discharges that pose a minimal (de minimus) threat to water quality such as, but not limited to, construction dewatering wastes not involving groundwater or storm water, discharges resulting from diverted stream flows, discharges resulting from hydrostatic testing, non-contact cooling water, etc.

The General Permit establishes numeric effluent limitations for oil and grease, sulfides, total suspended solids, total residual chlorine, and total petroleum hydrocarbons for authorized groundwater discharges and de minimus wastewater discharges. Additionally for groundwater discharges, the General Permit establishes effluent limitations for total nitrogen and total recoverable selenium in support of the nutrient and selenium TMDLs. This General Permit also requires development and implementation of an effluent monitoring program, with monitoring reports submitted to the RWQCB on a monthly basis.

3.4.5 General Discharge Prohibition

The Basin Plan (Chapter 5 Implementation) contains the following general discharge prohibitions, encompassing all Waters of the State within the RWQCB boundaries: "Unless regulated by appropriate waste discharge requirements, the discharge to surface or groundwaters of waste which contains the following substances is prohibited:

- Toxic substances or metals;
- Pesticides;

- PCBs;
- Mercury or mercury compounds;
- Radioactive substances; or
- Materials in excess of levels allowed by the California Code of Regulations.

3.4.6 Antidegradation Policy

Under the SWRCB's Antidegradation Policy (Resolution 68-16), whenever the existing quality of water is better than that needed to protect existing and probable future beneficial uses, such existing high quality is to be maintained until or unless it has been demonstrated to the state that any change in water quality:

- Will be consistent with the maximum benefit to the people of the state;
- Will not unreasonably affect present or probable future beneficial uses of such water; and
- Will not result in water quality less than prescribed in state policies.

Unless these three conditions are met, background water quality—the concentrations of substances in natural waters that are unaffected by waste management practices or contamination incidents—is to be maintained. If the SWRCB or a RWQCB determines that some water quality degradation is in the best interest of the people of California, some incremental increase in constituent concentrations above background levels may be permitted. However, in no case may such degradation cause unreasonable impairment of beneficial uses that have been designated for a Water of the State. The effect of this policy is to define a range of water quality—between natural background levels and the water quality objectives—that must be maintained. Within this range, the RWQCBs must balance the need to protect existing high quality water with the benefit to California as a whole of allowing some degradation to occur from the discharge of waste. The policy also specifies that discharges of waste to existing high quality waters are required to use "best practicable treatment or control," thereby imposing a technology-based limit on such discharges.

3.4.7 Groundwater Quality

The Irvine Groundwater Sub-Basin (portion of the Orange County coastal groundwater basin underlying the Watershed) is salty, with naturally-occurring salts from the original deposition of marine sediments. Therefore, the groundwater is considered marginal for drinking water uses. In addition, nitrate concentrations in some areas of the Sub-Basin are elevated due to historical and present use of agricultural fertilizers. Furthermore, the former Department of Defense facilities in this Sub-Basin have groundwater contamination that is currently being addressed. At former MCAS El Toro, water quality problems include a trichloroethylene (TCE) plume, fuel plume, and landfills. The Department of the Navy has accepted full responsibility for contaminant cleanup at this facility and is participating financially in the Irvine Desalter Project. The Irvine Desalter Project is a joint groundwater quality restoration project by the IRWD and Orange County Water District (OCWD), with financial participation by the Department of the Navy and the State of California and includes a purification plant that treats groundwater in the Sub-Basin to remove salts and nitrates caused by the natural geology and past agricultural drainage as well as two purification plants that remove volatile organic compounds from the groundwater contaminated by solvent degreasers used at the former MCAS El Toro. This groundwater, once cleaned is used only for irrigation and other non-drinking water uses.

At the former MCAS Tustin, water quality problems include a volatile organic compound (VOC) plume and a fuel plume. The Department of the Navy is completing their on-going efforts to remediate soil and water contamination left during the military's operation of the former base.

3.4.8 Water Quality Integrity

Water quality integrity is defined as the range of pollutant loading (i.e., nutrients, pesticides, hydrocarbons, and sediments) similar to that which historically characterized riparian ecosystems in the region. The key indicators of water quality integrity used in the Corps (2001) study included:

- Land Use/Land Cover – a measure of the extent to which the loading of nutrients, pesticides, hydrocarbons, and sediments exceeds natural levels; and
- Sediment Regime – a measure of the degree to which sediment dynamics in the stream channel are in equilibrium with the upstream sediment supply, and the erosion and deposition processes in the channel.

As discussed in Section 3.1.2, the Corps conducted a water quality characterization of drainages throughout the Watershed as part of the SAMP LLFA (Smith, 2000). The overall objective of the LLFA was to characterize and rank the "integrity" of the riparian ecosystems to provide the basis for evaluating the impacts on riparian ecosystems of various alternatives considered in the SAMP formulation process. The assessment was accomplished by dividing the riparian ecosystem along the project site drainages into assessment units or "riparian reaches" and assessing each riparian reach using a suite of indicators of ecosystem integrity.

One of the indicators assessed was water quality integrity. Riparian reaches characterized as having high water quality integrity were those where the range of pollutant loading (in the categories of nutrients, pesticides, hydrocarbons, and sediments) were determined to be similar to those that historically characterized riparian ecosystems in the region. The factors used in this characterization of water quality integrity included:

- No changes in land use/land cover in the areas tributary to the riparian reach;
- No changes in stream system that transports pollutants (e.g., no changes in frequency, magnitude, and temporal distribution of stream flow); and
- No changes in the riparian ecosystem condition with respect to its ability to physically capture and biogeochemically process pollutants (Smith, 2002).

Figure 3-13 shows the baseline water quality integrity rankings of the riparian reaches throughout the Watershed. Dark areas represent high scores where water quality integrity is high. Lighter areas represent reaches where water quality integrity has been reduced due to man-made disturbances and factors. The lowest integrity scores were observed along creeks where urbanization and agricultural activities have altered the channels and local drainage basins. The highest possible score for water quality integrity ranking is 45 (darkest). The results showed an integrity range from 13 to 42, with a mean score of 28. A total of 40.5 acres in the Watershed are ranked as having high water quality integrity, 58.7 acres are ranked medium quality, and 86 acres are ranked low quality.

Most drainages north of the SR-241 (such as upstream reaches of Round Canyon Wash, Agua Chinon Wash, Borrego Canyon Wash), portions of Serrano Creek, Needlegrass Creek, and some drainages in the undeveloped San Joaquin foothills have the highest water quality integrity scores, while the lowest scores are found in downstream channels including portions of San Diego Creek, Peters Canyon Wash and Veeh Creek. Shady Canyon Creek upstream of Sand Canyon Reservoir was generally characterized as medium to high water quality integrity, while reaches of Sand Canyon Wash downstream of the reservoir were characterized as medium water quality integrity.

3.5 OTHER RESOURCES AND ISSUES

3.5.1 Agricultural Resources

Agriculture has long been an important activity in Orange County as a result of good soil and favorable weather. Avocado and citrus groves, nurseries, and row crops all contribute to the County's economy. The amount of land in agricultural uses began declining in the 1940s as large areas were converted to urban uses. This trend continues today and is expected to continue. Within the Watershed, agricultural uses consist primarily of row crops, avocado orchards, and citrus in currently undeveloped flat areas in and near the City of Irvine. The most intensive agricultural activity in the central area is found in the northern portion of the Tustin Plain, including orchards, row crops, and horticultural operations north of the MCAS El Toro and north of Trabuco Road. Avocado and citrus groves are located adjacent to, and include portions of, Loma Ridge and portions of adjacent canyons. There are patches of unique farmland, farmland of statewide importance, and grazing land throughout the foothills of the Santiago Hills and along the northern foothills of the San Joaquin Hills.

The Resources Element of the Orange County General Plan as well as the General Plans of some cities (e.g., Orange, Irvine, and Tustin) include goals and objectives that promote the wise management of existing agricultural lands while still recognizing that such uses are temporary.

Two major landowners in Orange County, The Irvine Company and the Rancho Mission Viejo Company, have historically held the majority of property within agricultural preserves under the Williamson Act (County of Orange General Plan). In 1987, The Irvine Company filed notice of non-renewal on all of their remaining properties from their contract. Withdrawal of The Irvine Company properties from the agricultural preserve was completed in 1999. The remaining 22,000 acres in agricultural preserve belong to the Rancho Mission Viejo Company and are located outside of the Watershed.

Figure 3-13. Spatial Distribution of Ecosystem Integrity Scores, Water Quality

Growth projections through 2020 indicate the continued urbanization of the County. This urban development will continue to convert agricultural acreage to more intensive land uses. Objectives and policies presented in the Natural Resources Component of the Orange County General Plan identify opportunities for the preservation and maintenance of agricultural acreage. These policies have been developed to assist in the preservation of agricultural land in areas where infrastructure has not yet been provided for more intensive activities.

The City of Irvine's General Plan includes objectives and policies that encourage the maintenance of agriculture in undeveloped areas of the City until the time of development, and in areas not available for development. For example, one policy provides for farming opportunities in the community, where feasible and appropriate, through an Agricultural Legacy Program. This program facilitates limited scale agricultural operations and programs on public lands. Locations for implementation of the Agricultural Legacy Program include the following:

- Designated open space spine network;
- Designated open space areas not subject to the NCCP; and
- Other appropriate publicly owned lands.

Another policy permits agricultural use of land that is unsuitable for building because it is within flood plains, or is subject to hazards to public health, safety, and welfare or similar constraints that preclude development. Other policies permit agricultural uses, on an interim basis, on land designated for development and encourage and support federal and state legislation proposed for the purpose of preservation of agricultural lands which are compatible with the City's goals and objectives.

Some continuation of existing agricultural operations is planned for orchards, field crops and nurseries after build-out of planned development in the Watershed. Agricultural production within the development footprint would be phased out as new planned communities are implemented. The only expansion of agricultural operations would be associated with areas under power line easements and implementation of the Agricultural Legacy Program with the City of Irvine.. The Agricultural Legacy Program has over 500 acres.

3.5.2 Air Quality

The Watershed lies within the South Coast Air Basin (SoCAB), California's largest metropolitan region. The area includes the southern two-thirds of Los Angeles County, all of Orange County, and the western urbanized portions of Riverside and San Bernardino counties. The topography and climate of Southern California combine to make the SoCAB an area with a high potential for air pollution, which constrains efforts to achieve clean air. During the summer months, a warm air mass frequently descends over the cool, moist marine layer produced by the interaction between the ocean's surface and the lowest layer of the atmosphere. The warm upper layer forms a cap over the cool marine layer and inhibits the pollutants in the marine layer from dispersing upward. In addition, light winds during the summer further limit ventilation. Furthermore, sunlight triggers the photochemical reactions which produce ozone, and this region experiences more days of sunlight than many other major urban areas in the nation. (South Coast Air Quality Management District, 2003).

Regulatory Overview

Air quality in the project area is regulated by a cooperative effort between federal, state, and regional agencies, as described below:

Federal Authority - U.S. Environmental Protection Agency

Ambient air quality standards have been set by both the federal government and the state of California to protect public health and welfare with an adequate margin of safety. Pollutants for which National Ambient Air Quality Standards (NAAQS) or California Ambient Air Quality Standards (CAAQS) have been set are often referred to as criteria air pollutants. The term is derived from the comprehensive health and damage effects review that culminates in pollutant-specific air quality criteria documents, which precede NAAQS and CAAQS settings. These standards are reviewed on a legally prescribed frequency and revised as warranted based on new health and welfare effects data. Each NAAQS or CAAQS is based on a specific averaging time over which the concentration is measured. Different averaging times are based upon protection of short-term, high dosage effects or longer-term, low dosage effects. NAAQS may be exceeded no more than once per year; CAAQS are not to be exceeded. NAAQS and CAAQS are in place for the following criteria pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxides (SO_2), respirable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead.

Federal Attainment Status

A *nonattainment* designation indicates that the ambient air quality concentrations violate the AAQS. An *attainment* designation indicates that the air quality does not violate the established standard. An *unclassified* designation indicates that there are insufficient data for determining attainment or nonattainment.

State Authority - California Air Resources Board

The California Air Resources Board (CARB) is the state regulatory agency which: (1) sets and enforces emission standards for motor vehicles, fuels and consumer products; (2) sets health-based air quality standards; (3) conducts research; (4) monitors air quality; (5) identifies and sets control measures for toxic air contaminants; (6) provides compliance assistance for businesses; (7) produces education and outreach programs and materials; and (8) oversees and assists local air quality districts which regulate most non-vehicular sources of air pollution.

CARB approves regional air quality management plans (AQMPs) for incorporation into the State Implementation Plan (SIP). CARB and the local metropolitan planning organization, Southern California Association of Governments (SCAG), are responsible for preparing the portions of the SIP related to mobile source emissions. CARB implements the California Clean Air Act (CAA) requirements, regulating emissions from motor vehicles and setting fuel standards. The CCAA established the CAAQS for O_3, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, lead, visibility reducing particles, sulfates, hydrogen sulfide and vinyl chloride. California standards are generally stricter than national standards. Table 3-19 presents the California and National (Federal) Ambient Air Quality Standards.

Table 3-19. State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]		Federal Standards[2]		
		Concentration[3]	**Method[4]**	**Primary[3,5]**	**Secondary[3,6]**	**Method[7]**
Ozone (O_3)	1 Hour	0.09 ppm (180 $\mu g/m^3$)	Ultraviolet Photometry	---	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 $\mu g/m^3$)		0.08 ppm (157 $\mu g/m^3$)		
Respirable Particulate Matter (PM_{10})	24 Hour	50 $\mu g/m^3$	Gravimetric or Beta Attenuation*	150 $\mu g/m^3$	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 $\mu g/m^3$*		- -		
Fine Particulate Matter ($PM_{2.5}$)	24 Hour	No Separate State Standard		35 $\mu g/m^3$	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 $\mu g/m^3$*	Gravimetric or Beta Attenuation	15 $\mu g/m^3$		
Carbon Monoxide (CO)	8 Hour	9 ppm (10 mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	9 ppm (10 mg/m^3)	None	Non-dispersive Infrared Photometry (NDIR)
	1 Hour	20 ppm (23 $\mu g/m^3$)		35 ppm (40 $\mu g/m^3$)		
	8 Hour (Lake Tahoe)	6 ppm (7 $\mu g/m^3$)		--	--	--
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	--	Gas Phase Chemiluminescence	0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard	Gas Phase Chemilumine-scence
	1 Hour	0.25 ppm (470 $\mu g/m^3$)		--		
Lead (Pb)	30 days average	1.5 $\mu g/m^3$	Atomic Absorption	--	--	--
	Calendar Quarter	--		1.5 $\mu g/m^3$	Same as Primary Standard	High Volume Sampler and Atomic Absorption
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	--	Ultraviolet Fluorescence	0.030 ppm (80 $\mu g/m^3$)	--	Spectrophoto-metry (Pararosaniline Method)
	24 Hour	0.04 ppm (105 $\mu g/m^3$)		0.14 ppm (365 $\mu g/m^3$)	--	
	3 Hour	--		--	0.5 ppm (1300 $\mu g/m^3$)	
	1 Hour	0.25 ppm (655 $\mu g/m^3$)		--	--	
Visibility Reducing Particles	8 Hour	Extinction coefficient of 0.23 per kilometer – visibility of 10 miles of more (0.07-30 miles or more for Lake Tahoe) due to particles when the relative humidity is less than 70 percent. Method: Beta Attenuation and Transmittance through Filter Tape.		NO FEDERAL STANDARDS		
Sulfates (O_4S-22)	24 Hour	25 $\mu g/m^3$	Ion Chroma-tography*			

Pollutant	Averaging Time	California Standards[1]		Federal Standards[2]		
		Concentration[3]	Method[4]	Primary[3,5]	Secondary[3,6]	Method[7]
Vinyl Chloride (C_2H_3Cl)	24 Hour	0.01 ppm (26 µg/m^3)	Gas Chromatography			
Hydrogen Sulfide (H_2S)	1 Hour	0.03 ppm (42 µg/m^3)	Ultraviolet Fluorescence			

1. California standards for O_3, CO (except Lake Tahoe), SO_2 (1 and 24 hour), NO_2, PM_{10}, $PM_{2.5}$, and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded. California Ambient Air Quality Standards (CAAQS) are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.
2. National standards (other than O_3, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The O_3 standard is attained when the fourth highest eight hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150µg/m^3 is equal to or less than one. For $PM_{2.5}$ the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current Federal policies.
3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
4. Any equivalent procedure which can be shown to the satisfaction of the CARB to give equivalent results at or near the level of the air quality standard may be used.
5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
7. Reference method as described by the U.S. EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the U.S. EPA.
8. The CARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

Source: California Air Resources Board (11/10/06)

Data from the 2007 Draft Air Quality Management Plan (AQMP) indicate that the SoCAB is currently designated as a "severe-17" nonattainment area for the 8-hour O_3 standards. Assuming all the long-term mitigation measures stated in the 2007 Draft AQMP are successfully implemented, then the 8-hour O_3 standard could be met by year 2021. However, SCAQMD may request for a "bump up" in the non-attainment status to an "extreme" classification to extend the deadline to year 2024. This request will not be determined until year 2021 after assessing the success of all mitigation measures. For PM_{10} the SoCAB is designated "serious" nonattainment, and is required to meet the national 24-hour standard by 2010. The SoCAB is also in nonattainment for $PM_{2.5}$ and currently has until 2010 to achieve the national 24-hour and annual standards; but will be filing a five-year extension to 2015. The SoCAB is in attainment for NO_2 and SO_2. For CO the SoCAB has met the federal standards since 2003 and has requested for reclassification to attainment, but has not been officially redesignated in attainment.

Regional Authority - South Coast Air Quality Management District

The South Coast Air Quality Management District (SCAQMD) is the regional agency responsible for the regulation and enforcement of federal, state and local air pollution control regulations in the SoCAB. The SCAQMD operates monitoring stations in the basin, develops rules and regulations for stationary sources and equipment, primary agency responsible for preparing emissions inventory and air quality management planning documents, and conducts source testing and inspections. In compliance with the CAA, the SCAQMD develops and adopts the AQMP which includes control measures and strategies to be implemented to attain state and federal ambient air quality standards in the SoCAB. The SCAQMD then implements these control measures as regulations to control or reduce criteria pollutant emissions from stationary sources or equipment (point and area sources) and indirect mobile sources. The SCAQMD prepared and submitted the 2003 AQMP primarily to address the SoCAB nonattainment status for O_3 and PM_{10}. The current development of the 2007 Draft AQMP is to address the nonattainment status for 8-hour O_3 and $PM_{2.5}$ standards.

At the local level, SCAG aids in the development of the AQMP and facilitates coordination with local jurisdictions and subregional associations to develop transportation control measures, including indirect source control strategies for the local jurisdictions to implement.

Global Warming and the Regulation of Greenhouse Gases

Gases that trap heat in the atmosphere are often called greenhouse gases (GHGs), analogous to the way in which a greenhouse retains heat. Global warming is the observed increase in average temperature of the earth's surface and atmosphere, primarily caused by an increase of GHG emissions in the atmosphere. The current scientific community believes that human events and activities such as the industrial revolution and the increased consumption of fossil fuels (e.g., combustion of gasoline, diesel, coal, etc.), have heavily contributed to the increase in atmospheric levels of GHG emissions.

On April 6, 1990 the SCAQMD adopted a "Policy on Global Warming and Stratospheric Ozone Depletion." The policy commits the SCAQMD to consider global impacts in rulemaking and in drafting revisions to their Air Quality Management Plan (AQMP). In March 1992, the SCAQMD Governing Board reaffirmed this policy and adopted amendments to the policy to include the following directives:

- phase out the use and corresponding emissions of chlorofluorocarbons, methyl chloroform, carbon tetrachloride, and halons by December 1995;
- phase out the large quantity use and corresponding emissions of hydrochlorofluorocarbons (HCFCs) by the year 2000;
- develop recycling regulations for HCFCs;
- develop an emissions inventory and control strategy for methyl bromide; and,
- support the adoption of a California GHG emission reduction goal

In September 2006, Governer Schwarzenegger signed Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006. This new law added Division 25.5 (commencing with Section 38500) to the California Health and Safety Code related to air pollution, specifically greenhouse gas (GHG) emissions. The California Global Warming Solutions Act of 2006 defines GHG emissions as carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

AB 32 requires CARB to adopt regulations to require the reporting and verification of statewide GHG emissions and to monitor and enforce compliance with this program. CARB is required to adopt a statewide GHG emissions limit equivalent to the statewide GHG emissions levels in 1990, by the year 2020. CARB is required to adopt rules and regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions. Overall compliance with this program can be achieved through rules, regulations, orders, emission limitations, emission reduction measures, or market-based mechanisms. The bill allows CARB to adopt a schedule of fees to be paid by regulated sources of GHG emissions.

CARB's AB 32 implementation timeline is as follows:

Deadline	Action
January 1, 2007	AB 32 becomes effective.
July 1, 2007	Adopt a list of discrete early action GHG reduction measures that can be implemented before January 1, 2010.
January 1, 2008	Adopt regulations to establish a mandatory GHG reporting and verification program; define the 1990 statewide baseline; and adopt the baseline as the 2020 statewide cap.
January 1, 2009	Adopt a plan outlining how emission reductions will be achieved from significant sources of GHG emissions via regulations, market mechanisms, and other actions.
During 2009	Draft rule language to implement the "plan" and hold a series of public workshops.
January 1, 2010	Early action measures take effect.
During 2010	After workshops and public hearings, conduct a series of rule making efforts to adopt GHG regulations.
January 1, 2011	Complete major rule making for GHG reductions. May revise rules and adopt new ones after January 1, 2011 in furtherance of 2020 cap.
January 1, 2012	Adopted rules and market mechanisms take effect and are legally enforceable.
December 31, 2020	Deadline for California to achieve 1990 levels of GHG emissions.

AB 32 will create a new regulatory program intended to reduce statewide GHG emissions to 1990 levels. It is not yet clear how, or if, these future regulations will affect local governments or local land use planning decisions.

The California Climate Solutions Act of 2006 expressed the views of the State legislature - global warming poses significant adverse effects not only to California, but the entire world. Further, pursuant to 40 CFR Section 1500.1, NEPA is the national charter for the protection of the environment, establishes policy, sets goals and provides the means for carrying out the policy. NEPA also includes procedures to ensure that environmental information is available to public officials and citizens before decisions are made and actions are taken. CEQA Guidelines state that the basic premise behind that statute is to inform governmental decision makers and the public about the potential, significant environmental effects of proposed activities. As a result, a discussion of AB 32 and global warming impacts has been included in this EIS/EIR.

Given the current state of the scientific tools and uncertain regulatory environment, no significance thresholds have been established that would allow a lead agency to compare quantified results with such criteria and determine if an individual project's emissions are significant. The SCAQMD has recently stated in its environmental documents that until appropriate scientific tools are available to evaluate the global effects of a specific project and significance thresholds are developed and adopted, it will report

GHG emissions to the extent GHG emission factors are available, and will not make any conclusions regarding significance. Consequently, little regulatory or scientific guidance is available for analyzing the significance of GHG emission under CEQA or NEPA. In most situations, an individual project is unlikely to generate sufficient GHG emissions to influence global climate change. Instead, projects likely incrementally contribute to the cumulative global increase in GHG emissions.

3.5.3 Cultural Resources

Cultural resources are the tangible remains of human activities and events that took place over 50 years before present (BP). Cultural resources include prehistoric and historic archaeological sites, historic structures and districts, or any other physical evidence of human activity in the past. These resources are considered important for scientific, traditional, religious, and other reasons.

Ethnography

The Watershed was occupied by the Gabrielino and Luiseño tribes. They spoke related languages and shared fairly similar cultures. The Gabrielino occupied most of Orange and Los Angeles Counties, including the Watershed and adjacent southern Channel Islands. Their territory included the Newport Bay Region. The Luiseño have sometimes been divided into two distinct groups called the Juaneño and the Luiseño; however, these two groups practiced a similar culture and spoke a sufficiently similar language to be considered a single group. The territory of the Luiseño extended from a point near Aliso Creek south to Agua Hedionda Creek.

The Gabrielino lived at spots that provided adequate access to food and water and that were not likely to be flooded. Key resources probably included shellfish, fish, acorns, and deer. The Gabrielino often placed their settlements near the junction of several different habitats, providing some insurance against environment catastrophes that might afflict one of those habitats. The Luiseño developed similar strategies for coping with environmental variability and located their villages on ground near sources of reliable freshwater, and most foods and other resources could be obtained within a day’s travel from the village.

Historic Record

European exploration of California began in AD 1542 with the voyage of the Spanish explorer Juan Rodriguez Cabrillo. The Spanish landed in San Diego Bay and claimed the land for Spain. The journey led to the colonization of Alta California. Between 1769 and 1822, the Spanish established four presidios, two pueblos, and 21 missions. The Spanish intended the missions to be only temporary establishments, and used them to convert Indians to the Spanish Catholic faith and to assimilate them into the lower ranks of Spanish society.

Many Spanish outposts were founded along El Camino Real. El Camino Real is the route that Gaspar de Portola and his expedition traveled in AD 1769. Portola led this expedition from San Diego in order to find a route to Monterey and establish a settlement there. On July 22, 1769, the group entered Orange County. Traveling north, the group passed through the western foothills of the Santa Ana Mountains.

The Portola party may have camped twice at Tomato Springs (ORA-244), a site within the City of Irvine Planning Area 6 (some areas now under development). The first stop at Tomato Springs occurred on July 26, 1769 as the group headed north. The second visit took place on January 19, 1770, during Portola's return trip. No archaeological evidence of Portola's visit has been identified. Tomato Springs is also the site of a large important Late Holocene archaeological site.

The Spanish Mission period ended when Mexico won its independence from Spain in AD 1821. The period between the 1830s and the 1840s is known as the golden age of ranching in California because the Mexican governor gave huge land grants during this time. The Watershed includes two of these land grants and part of a third: Rancho San Joaquin, Rancho Lomas de Santiago, and Rancho Santiago de Santa Ana.

The governor granted Rancho San Joaquin to Don José Sepulveda in AD 1842. This rancho spanned an area totaling 48,803 acres, covering the foothills of the Santa Ana Mountains and south toward Newport Beach and Laguna Canyon. Sepulveda built an adobe house for his family on the ranch. The foundation of his adobe remains intact and is located in northeastern portion of the Watershed.

The governor granted Rancho Lomas de Santiago to Don Teodosio Yorba in AD 1846. The ranch totaled 47,226 acres, and was bounded on the north by the Santa Ana River, on the west by Rancho San Joaquin, on the east by the Santa Ana Mountains, and on the south by the Rancho Aliso. In AD 1860, William Wolfskill purchased this rancho.

Rancho Santiago de Santa Ana was granted to José Antonio Yorba in AD 1810 by the Spanish governor. The rancho covered an area of 62, 516 acres and stretched from the east bank of the Santa Ana River to the Santa Ana Mountains and west to the Pacific Ocean. Approximately 3,800 acres of the original land grant is located within the project area. Between the early AD 1800s and 1840s, livestock ranching was the primary economic resources of California.

The Mexican-American War lasted between AD 1846-1848. On February 2, 1848, the Treaty of Guadalupe Hidalgo was signed between the United States and Mexico. This treated ceded California, Nevada, New Mexico, Arizona, and parts of Colorado and Wyoming to the United States for $15,000,000, officially ending the war with Mexico. The Treaty of Guadalupe Hidalgo bound the United States to honor the legitimate land claims of Mexican citizens residing in those captured territories.

The Land Act of 1851 established a Board of Land Commissioners to review these records and adjudicate claims and charged the Surveyor General with surveying confirmed land grants. From AD 1852 to 1856, a Board of Land Commissioners determined that the validity of grant claims. The Board rejected land claims and reverted the land back to public domain and the land became fair game for squatters. Although the claims of some owners were eventually substantiated, the owners lost their lands through bankruptcy or the inability to meet the exorbitant interest on their legal debts.

Drought forced many of the landowners who survived the collapse of the cattle market to sell their property. As cattle ranching declined, sheep raising grew in importance and the industry reached its greatest prosperity during the Civil War. Don José Sepulveda sold his ranch in 1864 to a business partnership consisting of James Irvine, Llewellyn Bixby, Thomas Flint, and Benjamin Flint. The partnership was called Flint, Bixby & Company. Two years later they purchased Wolfskill's Rancho

Lomas de Santiago as well as a portion of Rancho Santiago de Santa Ana. Between AD 1864 and 1866, Flint, Bixby & Company added Rancho San Joaquin to its holdings, under James Irvine's management. The Company grazed about 30,000 sheep on 110,000 acres of the rancho by 1867.

In AD 1876, James Irvine I bought out his partners and became sole owner of Rancho San Joaquin and the property became known as the Irvine Ranch. Tenant farming was introduced and Irvine began subdividing land southeast of Tustin and selling the land in 40-acre parcels. In addition land was leased to tenant farmers and remains of these houses and associated trash deposits may still be present in the Watershed. James Irvine I died in AD 1886. In AD 1892, James Irvine II (also known as James Harvey Irvine, Sr.) inherited the ranch and he incorporated the Irvine Ranch Company.

Agriculture remained the primary activity on the Irvine Ranch until World War II. The United States Navy purchased 2,318 acres for the construction of the El Toro Marine Base and addition 1,600 acres for the Tustin Air Base. James Irvine, Sr. died in AD 1947. Upon his death 53.7 percent of The Irvine Company stock was assigned to the James Irvine Foundation. Irvine hoped that his foundation would continue to run the ranch as an agricultural empire. In AD 1960 The Irvine Company gifted 1,000 acres and sold an additional 500 acres to the University of California for a new campus in Irvine. In AD 1960, The Irvine Company hired William Pereira and Associates to create a master plan for the development of the Irvine Ranch. The Irvine Ranch is the largest master-planned area in North America and continues to be developed with commercial and residential uses as well as transportation facilities.

Paleontological Resources

Paleontological resources are fossils, which are found in sedimentary rocks throughout the study area. A fossil is any evidence of past life over 10,000 years old and, therefore, includes fossil plants, animals, and other traces of life (root casts, trackways, etc.). The entire study area, with the exception of a small area around Red Hill in Orange and a few areas in the San Joaquin Hills, is underlain by fossiliferous sedimentary rocks. Therefore, these areas are considered to have a high paleontological sensitivity. Unlike cultural resources, fossils are integral components of the rock unit and are likely to be encountered whenever ground disturbing activities impact intact sediments from these units. Thus, paleontological resources may be present even under existing development.

No paleontological sensitivity is present in igneous rocks of the Red Hill area and within diabase dikes of the San Joaquin Hills. High sensitivity is assigned to all areas where sedimentary units are at, or near, the ground surface. High sensitivity below 10 feet is assigned within the Tustin Plain where recent (Holocene) alluvium caps paleontological sediments. There is no "maximum depth" at which paleontological sensitivity in excavations is reduced to zero.

3.5.4 Floodplain Values

Floodplains are discussed in Section 3.3, Hydrology, Erosion and Sedimentation.

3.5.5 Geology/Soils

The Watershed is bounded on the south by the San Joaquin Hills and on the north by Loma Ridge, a part of the Santiago Hills. The central and major part of the Watershed is the relatively flat Tustin Plain. Most drainage is initially internal into the center of the Watershed, collecting in the Tustin Plain and then exiting westward, then southward into Upper Newport Bay, mainly via San Diego Creek.

Soils

Soils within the Watershed are complex and are divided into three primary landform areas: 1) the Lomas de Santiago Hills, 2) the Tustin Plain, and 3) the San Joaquin Hills. Figure 3-14 depicts the different soils underlying the Watershed. Soils of the Lomas de Santiago Hills (foothill soils) reflect their underlying geology and consist mainly of the Alo-Bosonico and Cieneba-Anaheim-Soper associations. Soils of the Tustin Plain (alluvial fan and coastal terrace) tend to become finer with decreased elevation, with much of the lower valley floor near Newport Bay composed of clay loam, clay adobe, or silty clay. Soils in the Tustin Plain consist mainly of the Metz-San Emigdio and Chino-Omni associations. Most of the lowland soils consisting of clay loam are alkaline. Soils in the San Joaquin Hills are primarily composed of the Cieneba-Anaheim-Soper, Myford, and Alo-Bosonico associations.

Expansion or shrink-swell potential varies depending on the clay and moisture content in the soil. The expansion potential of the soils in the Tustin Plain varies from moderate to very high for the Chino Omni association, low for the Metz-San Emigdio association, low to moderate for the Sorrento-Mocho association, and low to high for the Myford association.

About 250 acres of peat are part of the large San Joaquin Marsh located approximately two miles northeast of Upper Newport Bay. Coarser texture soils (no coarser than sandy loam) are downslope from most valley mouths of the Santiago Hills. Soil profiles surveyed in 1901 tend to show finer soil textures at the surface, often overlying coarser material. This is important because it suggests a mild hydrologic and erosional regime before settlement extending up to the time of the 1901 soil survey.

The Natural Resources Conservation Service (NRCS), formally the Soil Conservation Service (SCS), classifies soils into four hydrologic soil groups based on their infiltration characteristics and runoff potential. According to this classification, soil groups C and D will produce more runoff volume and higher peak flow than soil groups A and B, under a given rainfall condition. The County of Orange prepared soil maps, which designate the locations and various soil groups within the County. Major portions of the Santiago Hills and San Joaquin Hills contain hydrologic soil groups C and D, which possess low infiltration capacities. Natural soils in the central portion of the upper San Diego Creek mainly consist of soil group B, which has a higher infiltration capacity. Peters Canyon Wash upstream of the El Modena-Irvine Channel confluence is composed largely of group B with limited group A soils. In contrast, the drainage areas of the El Modena-Irvine channel, lower Peters Canyon Wash, and lower San Diego Creek (downstream of Peters Canyon Wash) mainly consist of soils with low infiltration capacities, namely soil groups C and D.

Figure 3-14. Soils Map

Mineral Resources

There are no known mineral resources in the Watershed that would be of value to the region and the state.

Seismicity

Over a dozen small, generally north-trending faults have been identified on the north face of the San Joaquin Hills, inside the Watershed. These faults continue to the north and into the central part of the Watershed, but are buried in alluvium or colluvium in the Tustin Plain. Cutting through this network of faults are the much lengthier Pelican Hill fault and Shady Canyon fault. None of these faults are noted as having been active from historical times, back through the beginning of the Pleistocene (i.e., 3 million years before present) and are therefore considered to be inactive. Larger faults close to the Watershed are the Newport-Inglewood Fault, the Whittier Fault, and the Elsinore Fault. More distant faults with a history of causing earthquakes and damage include the Palos Verdes Hills Fault, the Elysian Park Fault, the Sierra Madre Fault, the Cucamonga/San Jose Fault, the San Jacinto Fault, the San Andreas Fault, and the San Clemente Fault. A search of historical records for earthquakes within a 50 mile radius of the center of the Watershed located 48 earthquakes between a magnitude 5.0 and 7.0 (the search was conducted for earthquakes as large as magnitude 9.0, but none that large occurred), for the search years of 1800 to 1995 (Corps, 2001). Eight major earthquakes occurred on the Newport-Inglewood between 1920 and 1969, the most sizeable of which was the Long Beach earthquake of March 10, 1933, a magnitude 6.3 event with an epicenter offshore from Newport Beach (Corps, 2001). Although the Newport-Inglewood Fault passes through the Watershed, the several other large earthquake-producing fault zones in the region such as the San Andres, San Jacinto and Whittier-Elsinore faults, also have the potential to impact the Watershed.

The degree of groundshaking at any one location and the hazards associated with groundshaking vary depending on: 1) the earthquake magnitude; 2) the distance from the earthquake epicenter; 3) groundshaking from site-specific response; 4) soil and groundwater conditions; and 5) the type of structure/facility. Generally, groundshaking will be most severe in areas underlain by alluvium or thick slope wash deposits and least severe in areas underlain with bedrock.

Liquefaction, defined as the transformation of a granular material from a solid state into a liquefied state due to increases in pore water pressure, is a specific hazard resulting from groundshaking. Groundshaking associated with an earthquake is capable of providing the mechanism for liquefaction, generally in saturated, loose, medium- to fine-grained sands, silty sands, and certain types of clayey soils. Potential liquefaction impacts in the Watershed are in the lowlands, primarily where saturated sediments constitute the subsurface. General areas projected to be susceptible are much of the Peters Canyon Wash drainage and the Tustin Plain, San Diego Creek, and the margin of Upper Newport Bay (Corps, 2001).

3.5.6 Land Use

The 122-square-mile Watershed includes the cities of Irvine and Tustin, portions of unincorporated Orange County and the cities of Lake Forest, Laguna Hills, Laguna Woods, Orange, Santa Ana and Newport Beach. Predominant land uses in the area include commercial, residential, industrial and institutional uses with scattered agricultural and open space areas including parks, undeveloped areas, and the San Joaquin Freshwater Marsh. Also located within the western and eastern portions of the Watershed are the former Marine Corps Air Station (MCAS) Tustin (encompassing 1,673 acres), and former MCAS El Toro (encompassing 4,738 acres), respectively. The University of California, Irvine is located in the southwestern portion of the Watershed and encompasses 1,500 acres, some of which are dedicated to institutional uses including university facilities and student housing (Corps, 2001).

The increased demand for housing in Orange County has resulted in substantial land use changes from agriculture to urban development within the Watershed, especially over the last several decades. The entire western portion of the Watershed is developed, and urbanization continues to the east and south. Most of the vacant areas that remain in the largely developed Watershed fall into the category of committed open space reserve under the NCCP. The other remaining undeveloped or developing areas include the former MCAS Tustin and MCAS El Toro bases and City of Irvine planning areas (mostly agriculture or former agriculture areas). Figure 3-15 shows the extent of development in the Watershed.

Predicted future land use conditions are described in terms of general plan land use designations, the projected timing and conditions of build-out, and applicable land use development policies. The remaining large open space areas in the Watershed are primarily located in the foothill regions of the Santiago and San Joaquin Hills and near the Upper Newport Bay. In general, these areas correspond with the NCCP/HCP Reserve System, which includes: Laguna Coast Wilderness Park, Mason Regional Park, Peters Canyon Regional Park, Upper Newport Bay Nature Preserve, Whiting Ranch Wilderness Park, Upper Newport Bay Ecological Reserve and the University of California Irvine Natural Reserve System. Other vacant areas include remaining undeveloped City of Irvine Planning Areas, remnants of vacant land occur along portions of Peters Canyon, and as vacant infill lots in urbanized areas.

Agricultural Land

Agricultural lands occupy approximately eight square miles, which is over six percent of the Watershed (Corps 2001). There are patches of unique farmland, farmland of statewide importance, and grazing land throughout the foothills of the Santiago Hills and along the northern foothills of the San Joaquin Hills. (See Section 3.5.1, Agricultural Resources).

Landfills

Under the County Board of Supervisors, the Integrated Waste Management Department (IWMD) administers the solid waste management within the County. The Frank R. Bowerman Landfill, located in the foothills north of the former MCAS El Toro, is the only active landfill in the Watershed. However 22 closed sites are located throughout the County, three of which are located in the Watershed:

- Coyote Canyon Landfill;
- Lane Road Landfill; and
- San Joaquin Landfill.

Figure 3-15. Aerial Map of Watershed Showing Developed/Developing and Remaining Undeveloped Areas

County of Orange

Unincorporated Orange County comprises a substantial portion of the Watershed. The Orange County General Plan Land Use Element (LU-3-1) states that, "The final portions of the available land within the County will achieve first generation build-out sometime after the year 2020, varying somewhat by geographic area." It should be noted that Orange County considers build-out in conceptual terms only, as redevelopment and intensification will continue after all developable land has been used (Corps, 2001).

The Santiago Hills overlook the Watershed from the north and provide the largest remaining block of open space in the Watershed. These hills are largely protected from future development under the NCCP/HCP agreement. The Frank R. Bowerman Landfill is located north of State Route (SR)-241 in the Bee Canyon area, surrounded by NCCP reserve areas. The estimated closure date of the landfill is 2024. Upon closure, it is anticipated that the landfill site would be converted to a recreational facility. Much of the remaining land to the east and west of the landfill will be incorporated into the Limestone-Whiting Ranch Wilderness Park in the future (Corps, 2001).

Urbanization has rapidly diminished the amount of land available for agricultural production in the Watershed. Currently, less than six percent of the Watershed is comprised of agricultural fields. The remaining agricultural lands are generally located in the foothills of the Santiago Hills, in a few tracts north and west of the former MCAS El Toro.

City of Irvine

The City of Irvine encompasses 45 square miles and is the largest jurisdiction that lies completely within the Watershed. Approximately 29,156 acres or 38 percent of the Watershed, is within the City of Irvine. Over 60 percent of the City is currently developed. The City of Irvine estimates full build-out by 2040.

The City of Irvine's General Plan represents the long-range vision of the City. It is a comprehensive statement of Irvine's development and preservation policies for all geographic areas of the City and its sphere of influence, and the relationships between social, financial, environmental, and physical characteristics.

The Orange County Great Park, as proposed by the City of Irvine, is located in the center of Orange County at the former MCAS El Toro. Land uses planned in the proposed Great Park are open space/park, residential, cultural facilities, transit oriented development, golf courses, habitat preserve/wildlife corridor, sports parks, agriculture, auto center use, educational, research and development, institutional, exposition centers, and transportation facilities (Cotton Bridges Associates, 2003).

In addition to the proposed Great Park, the San Joaquin Hills offer the largest remaining undeveloped land in the City of Irvine. Those areas not protected from future development under the NCCP/HCP are currently undergoing development and will likely be fully developed within the next 10 years with planned residential communities. Other areas of ongoing and future development in the City of Irvine include:

- Remaining, residential , commercial, and industrial development south of Interstate 405 between Sand Canyon Road and Lake Forest Drive. Michelson Drive, Sand Canyon Road, and Lake Forest Drive may be extended through this area.

- Remaining commercial and industrial development west of Sand Canyon Road between Interstate 5 and 405.
- Remaining residential, industrial, and commercial development north of Interstate 5 and west of Culver Drive.

The City of Irvine will ultimately own over 4,000 acres of open space lands located in the southern portion of the City, and additional lands in the northern portion. In 2002, the City accepted the first 2,100 acres and now has responsibility for the management and operation of this land. As a signatory to the Central and Coastal Subregion NCCP/HCP, the City has certain obligations. To address those obligations, the City has developed the South Recreation and Resource Management Plan. The Plan was prepared to address the future access uses and facilities for the City's Open Space Preserve – South. Additional plans will be prepared at a later date for areas in the north. The Plan describes the City's program for permanent protection of significant, large-scale conservation and open space areas by public ownership. Through this program, visually significant ridgelines and hillsides, significant biotic communities (e.g., riparian, marsh, and oak woodland), recreational lands, archeological and paleontological resources and areas subjected to geophysical and societal hazards are permanently preserved.

The Open Space Preserve – South is located within the San Joaquin Hills, which parallels the Pacific Ocean and forms the City's southern boundary. The area consists of rolling terrain with moderately steep slopes, canyons and narrow ridges. Other features include the Shady Canyon fault, Bommer and Shady Canyons, and Quail Hill.

City of Lake Forest

Approximately 5,296 acres of the City of Lake Forest are located in the eastern portion of the Watershed and is largely developed. The Lake Forest Planning Area (PA) (City and sphere) consists of approximately 17.2 square miles (10,775 acres). The City's total land area, including its sphere of influence, is composed of: 37 percent residential uses, 29 percent open space, 17 percent commercial, 8 percent light industrial, 5 percent transportation facilities, and 4 percent public facilities. The City's General Plan policies emphasize establishing the City's identity, developing pre-incorporated Planned Communities, and phasing new development that is compatible with the community (City of Lake Forest 1994). Industrial development continues to occur to the north and south of SR-241 in the northern portion of the city. Full build-out is anticipated to occur prior to 2020 (Corps, 2001).

City of Laguna Hills

The City of Laguna Hills is almost completely built out. Approximately 758 acres of the City are located within the Watershed. Approximately 51.8 percent of the City is composed of Planned Community developments with their own specific development standards. Overall, the City is deficient in community facilities such as active parks and community centers. The General Plan addresses several land use issues, including the need to: 1) unify land uses in and around the Laguna Hills Mall and Saddleback Memorial Hospital; and 2) increase the overall intensity of the non-residential uses along the I-5 Freeway corridor. The General Plan focuses primarily on the maintenance of the City's residential neighborhoods (City of Laguna Hills 1994). Full build-out of the city is estimated to occur between 2010 and 2015 (Corps 2001).

City of Orange

The City of Orange is currently 95 percent developed (Corps, 2001). Approximately 1,041 acres of the City are located within the northeastern portion of the Watershed. Within the Watershed, the uses are residential (primarily single family units) and related greenbelts, and a small amount of commercial services.

City of Tustin

The entire city, approximately 7,087 acres, is located within the Watershed. The Tustin General Plan policies emphasize balanced, compatible, and complementary development in addition to the revitalization/redevelopment of older and historic areas. The City of Tustin estimates full build-out of the city by 2020. The largest remaining undeveloped area in the city is the former MCAS Tustin, which is located west of Jamboree Road and north of Barranca Parkway in the center of the Watershed. Reuse plans for the 1,606-acre former air station have been approved and many planned uses are currently under construction or completed. Planned uses includes a variety of housing, employment, recreation, educational, and community support facilities designed to complement the existing urban character of the surrounding area and strengthen the economic base of Tustin and nearby cities.

City of Santa Ana

Approximately 3,608 acres of the City of Santa Ana are within the southeastern portion of the Watershed. The city currently has an estimated build-out date of 2010, however, the portion of the city within the Watershed is essentially fully built-out. Currently, 97 percent of the city is developed, and there are no plans for any large-scale projects in the near future (Corps, 2001). Within the Watershed area, uses include industrial, commercial, residential, and open space. Since Santa Ana is an almost fully developed city, the goals and policies of the General Plan focus largely on the conservation, maintenance, and rehabilitation of existing property, while identifying opportunities for redevelopment and new development that serve to improve the employment tax base and quality of residential life in the city (City of Santa Ana, 1998).

City of Newport Beach

The City of Newport Beach forms the south/southwestern boundary of the Watershed. Existing land uses are primarily residential neighborhoods and commercial areas, as well as marine industrial uses. Approximately 2,966 acres of Newport Beach are within the Watershed. This portion of the city within the Watershed is characterized by light industrial and commercial uses in the vicinity of John Wayne Airport, and residential uses in the Bonita Canyon area (City of Newport Beach, 1998). According to the City's General Plan, ultimate residential build-out is projected to occur by the year 2010. Overall, open space in the City of Newport Beach will generally be limited to the foothills and land set aside for the NCCP/HCP (Corps, 2001).

City of Laguna Woods

The City of Laguna Woods was incorporated in March 1999. The City's General Plan and Housing Element were adopted in October 2002, with an amendment to the General Plan approved in July 2003. Within the Watershed, the City is developed with a variety of residential and commercial uses and a golf course. Approximately 1,033 acres of the city are located within the Watershed.

Irvine Ranch Land Reserve

The Irvine Ranch Land Reserve comprises more than 50,000 acres of permanently protected open space. The entire Reserve stretches 22 miles from the mountains to the sea and is home to hundreds of species of native plants and animals. The Reserve includes massive regional open space systems in the northern and southern hillsides of Irvine, and extends to the Laguna Coast Wilderness Park and Crystal Cove State Park near Laguna Beach. The open space and recreational parks within the Reserve include:

- Anaheim Wilderness Area
- Bommer Canyon
- Crystal Cove State Park
- Fremont Canyon
- Irvine Lake
- Irvine Regional Park
- Laguna Coast
- Mason Regional Park
- Peters Canyon
- Round Canyon
- San Joaquin Wildlife Sanctuary
- Santiago Canyon
- Upper Newport Bay
- Weir Canyon

In October 2006, 37000 acres of the Reserve (corresponding to the NCCP/HCP areas) were designated a National Natural Landmark for its biological and geological diversity. A substantial portion of the Reserve is within the Watershed.

3.5.7 Noise

Noise is defined as unwanted sound, typically considered unpleasant and bothersome. The most pervasive noise sources in the Watershed are mobile noise sources such as motor vehicles, railroads, and aircraft. In addition to the arterial and local street system, two interstate freeways (I-5 and I-405), four toll road corridors (State Routes 73, 261, 241, and 133), and several railroad tracks traverse or are adjacent to the Watershed. Motor vehicle noise is characterized by a high frequency of events, short duration, and proximity to areas sensitive to noise exposure. Noise levels on and adjacent to major streets are relatively constant, whereas they are intermittent on neighborhood streets where traffic is lighter. The Community Noise Equivalent Level (CNEL) is commonly used by California local governments to quantify community noise levels and standards. The CNEL is an average of noise levels over a twenty-four hour period, with penalties applied for evening and night time periods.

John Wayne Airport is located just outside the Watershed. Located within the western and eastern portions of the Watershed are former MCAS El Toro and former MCAS Tustin. Both are planned for reuse, with some construction currently underway at former MCAS Tustin.

The noise contours for MCAS El Toro were generated as part of a 1981 Air Installation Compatible Use Zone (AICUZ) and reflect the military use noise levels. These contours were adopted by the County of Orange as the “Policy Implementation Line,” or PIL, and remained the adopted policy of the County until they were recently rescinded by the County Board of Supervisors. There are restrictions on the types of land uses that can be developed within noise contours of 65 CNEL or greater. The City of Irvine General Plan includes an adopted noise contour for the MCAS Tustin base that reflects previous helicopter activity. There is no aviation use contemplated in the MCAS Tustin reuse plan.

Railroad noise is the result of the mechanical processes of the engine, the interaction of the wheels with the track, and the use of the whistle. Generally speaking, the noise generated by spur lines in industrial areas is insufficient to provide contours in excess of 60 CNEL outside the railroad right-of-way. Higher level noise contours adjacent to active tracks with a substantial high number of operations may extend up to several hundred feet on either side of the tracks. Within the Watershed, the only areas adjacent to existing railroad tracks (roughly between Walnut Avenue and Irvine Center Drive) are already developed, with the exception of the slated redevelopment of MCAS El Toro. These tracks traverse from northwest to southeast and are used for passenger (Amtrak) and commercial transport (BNSF). The Amtrak train stops within the Watershed at the Irvine Regional Transportation Center at 15215 Barranca Street in the City of Irvine.

3.5.8 Public Health and Safety

Emergency Response Plan

The County of Orange is responsible for preparation, maintenance, and implementation of emergency response plans and emergency evacuation plans for the County of Orange. The County coordinates with all local jurisdictions and emergency service providers within its boundaries. The County recently revised the Orange County Emergency Management Plan (EMP), which is the official emergency plan for the County. The EMP addresses the County's response to extraordinary emergency situations associated with natural disasters, technological incidents, and nuclear protection. In addition, it provides operational concepts related to emergency situations and identifies the components and describes the responsibilities of the Local Emergency Management Organization for protecting the life and property of Orange County citizens.

An EMP has been prepared for the City of Irvine to provide guidance for the city's response to extraordinary emergency situations associated with natural disasters, technological incidents, and natural security emergencies. The city's EMP focuses on potential large-scale disasters which can generate unique situations requiring unusual emergency responses. The objective of the EMP is to incorporate and coordinate all the facilities and personnel of the city into an efficient organization capable of responding to any emergency.

The cities of Laguna Hills, Laguna Woods, Lake Forest, Newport Beach, Orange, Santa Ana and Tustin have also prepared EMPs for their city. These plans will guide the cities during natural disasters and other types of emergencies.

Fire Hazards

The foothills areas of Orange County are considered high to very high fire hazard areas. The portions of the Watershed most susceptible to wildland fires are the San Joaquin Hills and the outlying foothills of the Santiago Hills and the Santa Ana Mountains. The Orange County General Plan Safety Element identifies fire hazard areas. Portions of the Watershed are within areas designated as being subject to moderate to high fire hazard along the Watershed perimeters, in the vicinity of the former MCAS El Toro, and in the unincorporated area between the cities of Tustin and Orange. The Land Use Element of the General Plan states:

> *"The foothill areas of Orange County are considered high to very high fire hazard areas. Future development in these areas must minimize potential fire hazards and adequate fire protection must be maintained. Both these actions may raise development costs but will not preclude development."*

The Orange County Fire Authority (OCFA) serves more than one million residents in 20 member cities and the unincorporated areas of Orange County including all municipalities in the Watershed. OCFA provides fire protection and emergency service response, and participates in the California Mutual Aid Master Plan for use and assignment of resources for daily operations, and in the event of major emergencies. The Fire Authority headquarters and Emergency Operation Center (EOC) is located within the Watershed at Tustin Ranch and Jamboree Roads. This center became operational in 2004.

The OCFA protection area is diverse and the delivery system must be as well. Three demand categories exist within OCFA:

- *Urban:* Industrialized areas and high density housing areas;
- *Suburban:* Communities with mostly one- and two- story single family dwellings or moderate density with a maximum of three story buildings; and
- *Rural:* Canyons and ranch area or portions of the protection area that plan to remain less developed.

Much of the open space/vacant areas of the southern and northern perimeter of the Watershed perimeters are covered by native and non-native vegetation. Of these different vegetation types, coastal sage scrub, chaparral, and grasslands reach some degree of flammability during the dry summer months and, under the right conditions, during the winter months.

Topography has considerable effect on wildland fire behavior and on the ability of firefighters and their equipment to take action to suppress those fires. For example, a fire starting in the bottom of a canyon may burn quickly to the ridge and become large, before initial attack forces can arrive, simply because of topography. Rough topography greatly limits road construction, road standards and accessibility by ground equipment. Steep topography also channels air flow, creating extremely erratic winds on slopes and in canyons.

In an effort to alleviate fire dangers near the interface between urban development and wildlands, the construction of fuel modification zones (firebreak, fuelbreak, or greenbelt) has been required by the OCFA. The most effective fire prevention measures to reduce the level of risk to structures with wildland exposure are those that are incorporated into the design of the development rather than modifications to the natural resource areas.

Vectors

A vector is any insect or arthropod, rodent, or other animal of public health significance capable of harboring or transmitting the causative agents of disease (e.g., plague, malaria) to humans [Orange County Vector Control District (OCVCD) website, www.ocvcd.org, July 8, 2002]. Pests and/or vectors of concern that have the potential to transmit diseases are mosquitoes, flies, rodents, and waterfowl.

Mosquitoes

Mosquitoes are flying insects that breed in standing water and are considered a pest as well as a known vector of human and animal pathogens. Orange County currently has 19 recognized species of mosquitoes; however, it has three common species that are associated with carrying either encephalitis viruses or malaria protozoans. These species include: the southern house mosquito (*Culex quinquefasciatus*), the western encephalitis mosquito (*Culex tarsalis*), and the southern malaria mosquito (*Anopheles hermsi*). The first two species are known to periodically transmit the St. Louis encephalitis (SLE) virus, and the last species has the potential of transmitting human malaria parasites. Several mosquito species found in Orange County (e.g., *Cx. quinquefasciatus*) are considered to be competent hosts and vectors of the West Nile Virus. Mosquitoes could potentially breed at any site that has standing water for more than 72 hours.

There are several alternatives for controlling mosquito populations in the urban environment. The type of control used depends on the urgency, weather, time of year and treatment area. The primary abatement alternatives include: reduction of breeding sites (i.e., removal of stagnant water), synthetic pesticides, biochemical pesticides and biological controls (use of natural predators). Secondary abatement measures include flooding or draining of the facilities, water surface agitators, increased biochemical pesticide application, trapping and killing pests, and lastly, chemical pesticide application.

Flies

There are several types of flies that are a concern in southern California, the most important of which include houseflies (*Musca domestica*), lesser houseflies (*Fannia* sp.), blowflies (*Phaenicia* sp.), flesh flies (*Sarcophagidae*), and latrine flies (*Chrysomyia* sp.). All of these have the potential of transmitting human disease. The most effective method of controlling fly populations is to minimize breeding sites. Other methods of control are similar to the methods for mosquito control and include the application of synthetic pesticides, biochemical pesticides, and biological controls (use of natural predators).

Rodents

Rats, squirrels, mice, chipmunks, beavers, and muskrats are rodents that may inhabit stormwater infrastructure and thus raise human health concerns. Rodents are capable of transmitting diseases, and can be carriers or hosts for several pathogens that may get transmitted to humans by biting insects, such as mosquitoes. From a human health perspective, the rodent of most concern in Orange County is the roof rat (*Rattus rattus*). Removal of potential breeding grounds and food and water sources is the best method of rodent control. Traps are an effective method of reducing nuisance rodent populations. The use of poisons is the least preferred method of control.

Brown-headed Cowbird

The Brown-headed cowbird (*Molothrus ater*) is a regular nest parasite of over 150 host species of North American birds, the majority of which are songbirds. There are several bird species in southern California that are being threatened by cowbird parasitism as well as habitat reduction, including the following state- and federally listed threatened or endangered species: least Bell's vireo (*Vireo bellii pusillus*), the southwestern willow flycatcher (*Empidonax trailli extimus*), and the California coastal gnatcatcher (*Polioptila californica californica*). The IRWD water quality treatment wetlands may provide substantial habitat for a variety of songbirds, such as those described above. However, the proximity to suburban landscapes, agriculture, and livestock may also make this habitat ideal for cowbirds. (Refer to Section 3.3 for information on existing bird populations in the Watershed.) The primary cowbird control method is trapping.

Vector Control

The OCVCD is the agency responsible for protecting public health by controlling rats, flies, mosquitoes and other vector related problems. OCVCD vector control programs are based upon scientific approaches that have been incorporated into a comprehensive strategy of Integrated Pest Management (IPM). This management strategy includes all available options from public education to chemicals for effective control of vectors. Because of its application specifically engineered to controlling vectors, this management approach is referred to as Integrated Vector Management (IVM).

OCVCD programs for vector control rely more on prevention, exclusion, and public education, with use of chemicals as the least desirable method of control. If the application of chemicals is necessary, the products used include those recognized by the U.S. EPA as minimizing adverse impacts to the environment and relatively low toxicity for humans and wildlife (Class III or “Caution” products).

Hazardous Wastes

Current and historic land uses within the Watershed that have resulted in contamination by hazardous and toxic materials and waste have the potential to adversely affect water quality within San Diego Creek and its tributaries. Depending on their location, contaminated sites can affect creek water quality either directly or indirectly through Watershed features such as surfaces and subsurface soils, storm water channels, and groundwater aquifers. Surface soils and storm water channels tend to release contaminants during storm events, with the magnitude of the impact depending on the degree of contamination and type of contaminant. Subsurface soil contamination can impact a creek either via subterranean soil water migration or through contamination of groundwater aquifers that connect to the creek or its tributaries. Additional factors influencing the magnitude of impact of previous and existing contaminated sites are factors such as location in the Watershed, soil types, geology aspect, and vegetation communities within and proximate to the subject sites.

The Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund Act, primarily addresses the cleanup of designated Superfund hazardous waste sites. To achieve its stated purpose, CERCLA establishes a Hazardous Substances Trust Fund, the Emergency Trust Fund, and the Post-Closure Liability Trust Fund. This Act provides money necessary for the decontamination of the environment. A list of known hazardous wastes sites that are under consideration for the Superfund list is compiled by the U.S. EPA. This list is referred to as the CERCLIS database. Fourteen Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) sites were identified within the Watershed.

Of the 14 sites, only one site was identified as a National Priority List (NPL) site. NPL sites are commonly referred to as Superfund sites that are known hazardous sites and require immediate cleanup. The NPL site within the Watershed is the former MCAS El Toro, which occupies approximately 4,700 acres. A total of 25 potentially contaminated areas were identified on this site, including four landfills suspected of containing hazardous and solid waste and other areas where PCB, battery acids, leaded fuels, and other hazardous substances were suspected of being dumped or spilled. A remedial investigation conducted at the base identified VOC, primarily trichloroethylene (TCE), in groundwater that has migrated more than three miles off the base. The Department of the Navy has been responsible for the on-going clean-up of contaminated areas at this site and in groundwater.

The Resource Conservation and Recovery Act (RCRA) established a national waste management program as of 1984. Under this act, hazardous wastes must be tracked from the time of generation to the point of disposal. A program must be instituted by every generator and handler to manage hazardous waste in a manner that minimizes the present and future threat to the environment and human health. Each hazardous waste generator must register and obtain an U.S. EPA identification number under RCRA regulations and (except for small quantity generators) must file reports periodically to inform the U.S. EPA of their activity. An inventory of facilities listed on the RCRA database identified hundreds of generators within the Watershed.

3.5.9 Recreation

Orange County has 31 inland and 27 coastal regional recreation facilities. Comprising more than 27,000 acres, these facilities include regional parks, county harbors and beaches, marine life refuges, and historical sites. An additional 24,000 acres are proposed for acquisition in the County, increasing Orange County's public recreation land to over 50,000 acres (Orange County General Plan Recreation Element, 2000). Regional parks and trails in the Watershed are addressed in the section below.

Regional Parks

The Recreation Element of the County General Plan defines a regional park as a park with countywide significance and of greater size than a local park to accommodate regional recreational activities. This element classifies regional recreational facilities into several categories: Urban Regional Park, Natural Regional Park, Wilderness Regional Park, County Wilderness Areas, Nature Preserves, Regional Harbors, Regional Beaches, and Historic Sites. The latter three categories are not relevant to the Watershed or are addressed in other sections (e.g., Cultural Resources section).

The regional parks serve two purposes: preservation/protection of natural habitat and wilderness areas, and provision of opportunities for recreation or scenic attractions that are of countywide significance. Figure 3-16 shows regional recreational resources. The five regional parks discussed below are located within or adjacent to the Watershed boundaries.

Laguna Coast Wilderness Park

The Laguna Coast Wilderness Park (LCWP) is located in the San Joaquin Hills, adjacent to the Watershed on southeast, between the cities of Newport Beach, Irvine, Laguna Hills, and Laguna Beach. This approximately 6,300-acre park is jointly owned by the City of Laguna Beach, the County of Orange, and the Department. Primary usage within the LCWP is habitat preservation and passive recreation. Recreational use within the park is restricted to hiking, mountain biking, equestrian use, and picnicking. No waterbodies within the Watershed have been identified in the LCWP.

Peters Canyon Regional Park

Peters Canyon Regional Park is located in the northwestern portion of the Watershed, within the City of Orange, and is bounded on the east by Jamboree Road, south of Santiago Canyon Road and Chapman Avenue. The 354-acre park contains native habitat including coastal sage scrub, riparian, freshwater marsh and grassland habitats, and the 55-acre Upper Peters Canyon Reservoir. Peters Canyon Creek traverses the park from north to south. Willows, sycamores and black cottonwoods line the reservoir and the Creek. The Park is owned and managed by the County of Orange and contains a variety of recreational trails along Peters Canyon Creek. The upper portion is outside the Watershed, while the lower portion is within.

Upper Newport Bay State Ecological Reserve/Upper Newport Bay Regional Park

The Upper Newport Bay State Ecological Reserve/Upper Newport Bay Regional Park is located in Newport Beach at the southwestern corner of the Watershed, beginning where San Diego Creek outlets to Upper Newport Bay at the Jamboree Road Bridge. Pacific Coast Highway, Back Bay Drive, Eastbluff Drive, Jamboree Road, the Orange County Regional Park, and the Dover cliff bluffs generally bound the reserve. This 756-acre reserve provides essential habitat for a number of state and federally-listed threatened and endangered species, including the salt marsh bird's-beak, California brown pelican, American peregrine falcon, light-footed clapper rail, California least tern, and Belding's Savanna sparrow. The Park is owned and managed by the County of Orange. Recreational activities include hiking, biking, equestrian riding, fishing, boating, and interpretive programs.

Figure 3-16. Regional Recreational Resources within the Watershed

Whiting Ranch Wilderness Park

Whiting Ranch Wilderness Park is owned by the County and managed by the Nature Conservancy. It is located within the foothills of the Cleveland National Forest, west of Santiago Canyon Road between Modjeska Canyon Road and Live Oak Road, and is bordered by the communities of Foothill Ranch and Portola Hills. The westerly portions of the park are within the Watershed. Adjacent to Whiting Ranch Wilderness Park is Limestone Canyon, also known as the Northern Reserve, which was donated to the County by The Irvine Company. A 640-acre portion of Limestone Canyon, known as the Hangman Tree area, was incorporated into the Whiting Ranch Wilderness Park in the fall of 1999, increasing the size of Whiting Ranch Wilderness Park to approximately 2,400 acres. The remainder of Limestone Canyon, approximately 7,000 acres, while donated, has yet to be incorporated into the Whiting Ranch Wilderness Park. Three streams flow through Whiting Ranch, including Borrego, Serrano and Aliso Creek; the latter is located outside the Watershed. These streams are intermittent in the upper reaches and become more perennialized in the lower reaches. Recreational activities in Whiting Ranch include horseback riding, hiking, and mountain biking.

William R. Mason Regional Park

William R. Mason Park is located in the southern portion of the Watershed in the City of Irvine. The park is bounded by University Drive to the north and bisected by Harvard Avenue, Culver Drive, and Ridgeline Drive in Irvine. The 345-acre park, owned and managed by the County of Orange, contains open space, grassy knolls, and natural areas. The recreational opportunities include picnic areas, softball back stop, large turf areas, hiking and bicycling trails, three sand volleyball courts, a physical fitness vita course, three tot lot playgrounds, amphitheater, and nine acre lake (supplied with reclaimed water from IRWD). San Diego Creek is located near the Park, paralleling University Drive.

Proposed Regional Parks

The City of Irvine has proposed the Orange County Great Park as part of the re-use of the former MCAS El Toro, located in the central portion of the Watershed. The total project area encompasses approximately 4,800 acres, or 7.5 square miles. Proposed recreational land uses planned in the project area include open space/park, cultural facilities, golf courses, habitat preserve, and trails along wildlife and riparian drainage corridors.

Local and Regional Riding and Hiking Trails and Off-Road Bikeways

The County Recreation Element envisions a countywide system of trails for hiking, equestrian, and non-motorized biking uses. A total of 349 miles is proposed, with approximately 96 miles remaining to be constructed. The system would connect all beaches, parks, and other open space areas, allowing a user to travel from the ocean to the Cleveland National Forest. Existing trails are largely off-road and unpaved. Per the goals and objectives of the Recreation Element, these trails are intended to be used by people on a year-round basis. Public safety is a major consideration in design, construction, and maintenance. Acquisition is through a variety of means, including the land development process, public/private partnerships, and dedications.

Trails create a web of connective paths throughout the Watershed. They link many of the regional parks, and are adjacent to or alongside some of the drainage channels and other watercourses. Trails located or proposed to be within the boundaries of the Watershed are described below.

Atchison Topeka & Santa Fe (AT&SF) Bikeway

This existing 4-mile Class I (off road) bikeway extends along the AT&SF Railroad between Peters Canyon Bikeway and Sand Canyon Road in the City of Irvine.

Borrego Canyon Bikeway

This Class I bikeway is located along Towne Centre Drive near the intersection of the Foothill Transportation Corridor (SR-241) and Alton Parkway. An extension is proposed from this area north to the Irvine Multimodal Transportation Center, according to the County of Orange Bikeways Plan. The proposed bikeway would cross the eastern tributary of the Borrego Canyon Wash, underneath the Foothill Transportation Corridor (SR-241). The combination of existing and proposed bikeway segments will be approximately six miles long.

Hicks Canyon Riding/Hiking Trail and Bikeway

The horseback riding and hiking portion of this trail is proposed to extend approximately five miles from Whiting Ranch Wilderness Park to connect with Peters Canyon trail. This trail would cross Hicks Canyon Wash, near the proposed Jeffrey Road extension, north of Portola Parkway. The Class I bikeway currently exists between Culver Drive and east of Yale Avenue for approximately one-half mile.

Irvine Coast Trail

This existing trail commences at Upper Newport Bay Regional Park, heads east along the San Diego Creek trail, enters William R. Mason Regional Park, borders the Turtle Rock area, goes south to Bommer Canyon, and finally connects to Crystal Cove State Park. This trail is approximately 10 miles long and runs adjacent to and/or across San Diego Creek Channel, Sand Canyon Wash, and Bommer Canyon Creek.

Jeffrey Road Bikeway

This bikeway is both existing and proposed. The existing portion of this bikeway extends for two miles along Jeffrey Road between the 405 Freeway and the AT&SF Bikeway. The planned section will continue south to Mason Regional Park and north to the Irvine Lake area. The total length of the planned trail will be approximately 10.5 miles. This bikeway will cross or be adjacent to the Hicks Canyon Wash, Central Irvine Channel, Como Storm Channel, San Diego Creek Channel, San Joaquin Channel, and Sand Canyon Wash.

Peters Canyon Trail

This trail commences at Peters Canyon Regional Park at Peters Canyon Reservoir, heads south through Tustin, then along the Peters Canyon Wash Channel, the San Diego Creek Channel, and ends just north of Campus Drive, where the Irvine Coast Trail crosses the San Diego Creek Channel. The length of this trail is approximately 10 miles. There are 2-, 4-, and 8-mile loops along this trail within Peters Canyon Regional Park.

San Diego Creek Bikeway

The existing portion of this bikeway extends along San Diego Creek from Newport Beach to Jeffrey Road in Irvine. The planned extension will continue to follow San Diego Creek east of Jeffrey Road to Old Laguna Canyon Road, and will then divide; the southern portion will extend just past the 405 Freeway and the northern portion will connect with Lake Forest Drive. The existing portion of this bikeway is approximately eight miles long; the planned portion is approximately six miles long.

Sand Canyon Bikeway

This existing approximately 2-mile bikeway extends along the west side of Sand Canyon Avenue between the San Diego Freeway and the AT&SF Bikeway, just south of the I-5 Freeway. This bikeway crosses the San Diego Creek at Sand Canyon Avenue.

Serrano Creek Riding and Hiking Trail

This approximately 6-mile riding and hiking trail is located in the City of Lake Forest. The trail begins at Serrano Creek Park and follows the Creek to Whiting Ranch Wilderness Park. For the past three years, the County, OCFCD, City of Lake Forest, and the Serrano Creek Conservancy along with other agencies and local citizens have been working to restore Serrano Creek. Programs have been implemented to control erosion along the Creek and plant trees in the Serrano Creek Park. Restoration of the creek is ongoing.

3.5.10 Socioeconomics

The Watershed includes all of the cities of Irvine and Tustin and portions of the cities of Newport Beach, Laguna Hills, Laguna Woods, Lake Forest, Orange, and Santa Ana, along with portions of unincorporated Orange County. The majority of the Watershed is within the City of Irvine or its sphere of influence and has been included in the City of Irvine General Plan.

Based on census figures, the population of Orange County in the year 2004 was 2,987,591 (U.S. Census Bureau 2004). The county grew by 24.7 percent between 1980 and 1990, and by 18.1 percent between 1990 and 2000. The fastest growing city in the County was Tustin at 33.2 percent between 1990 and 2000 due to the Tustin Ranch development area.

The City of Irvine has reached the halfway point of its projected population growth. Population growth as a yearly percentage has slowed considerably as the City has matured. Between 1970 and 1980, population increases averaged 20 percent per year. Between 1980 and 1990, the average increase dropped to 8 percent per year; and since 1990, the annual increase has averaged 2 percent per year (City of Irvine 2003). Table 3-20 shows Orange County Projects 2004 (OCP-2004) population in five-year increments for the City of Irvine and Orange County. Based on this table, Orange County is projected to grow by approximately 458,300 people by the year 2030.

Table 3-20. OCP-2004 Population[1]

	Population					
Jurisdiction	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Irvine	182,890	192,185	197,280	200,291	202,291	203,964
Orange County	3,094,461	3,291,628	3,402,964	3,485,179	3.537.559	3,552,742

[1] Source: Center for Demographic Research, California State University, Fullerton

Minority Population

The majority of residents within the Watershed are non-Hispanic Whites, with Hispanics and Americans of Asian descent forming the second and third largest ethnic and racial groups, respectively (U.S. Census Bureau 2003). The cities of Irvine and Santa Ana support a larger population of minority groups than the other portions of the Watershed (Corps 2001).

Housing

In Orange County, 1990-1994 housing production lagged demand by 13,600 units. In 1995-1997, the County's home construction lagged demand growth by nearly 25,000 units, or by 4.1 percent as compared to inventory (University of California Berkeley 2000). Table 3-21 provides a summary of OCP-2004 housing projections in five-year increments for the City of Irvine and Orange County.

Table 3-21. OCP-2004 Dwelling Units[1]

	Dwelling Units					
Jurisdiction	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Irvine	53,750	63,200	64,904	66,686	68,439	68,883
Orange County	978,004	1,066,476	1,086,044	1,100,848	1,112,915	1,118,429

[1] Source: Center for Demographic Research, California State University, Fullerton

While it is estimated that Orange County will add approximately 140,000 dwelling units by 2030, the population is expected to grow at a faster rate than housing. For every unit added, the County will add another four people (William Gayk, CDR-Cal State University Fullerton).

SCAG is mandated to prepare a Regional Housing Needs Assessment (RHNA) and to allocate "fair share" housing needs for cities and counties within its jurisdiction, which includes Orange County. SCAG's adopted RHNA Construction Need for some of the key cities in the Watershed are shown in Table 3-22. These numbers are the housing production targets through 2005. No new data is available at this time.

Table 3-22. Adopted Regional Housing Needs Assessment Construction Need[1]

Jurisdiction	Need
City of Irvine	10,782
City of Tustin	3,298
City of Santa Ana	1,339
City of Lake Forest	183

[1] Source: Center for Demographic Research, California State University, Fullerton

Each jurisdiction's approach to meeting these targets is reflected in its General Plan, including the Housing Element. For example, the City of Irvine has adopted housing policies addressing achievement of housing production and meeting RHNA goals in its 2000-2005 Housing Element.

Employment and Income Levels

Unemployment rates for Orange County and the City of Irvine are 3.3 percent and 3.5 percent, respectively (U.S. Census Bureau 2003). For the year 2000, the median household income for Orange County is $58,820 and City of Irvine is $72,057 (U.S. Census Bureau 2003).

Existing and Projected Jobs

Table 3-23 shows OCP-2004 employment projections in five-year increments for the City of Irvine and Orange County. Jobs created in the County are expected to increase by approximately 419,400 by the year 2030.

Table 3-23. OCP-2004 Employment[1]

	Employment (Jobs)					
Jurisdiction	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Irvine	176,986	209,464	227,879	248,731	252,940	261,309
Orange County	1,502,434	1,749,985	1,816,387	1,858,579	1,896,752	1,921,800

1 Source: Center for Demographic Research, California State University, Fullerton

Southern California Association of Governments

In general, SCAG policies encourage job and housing opportunities to be balanced at the county or Regional Statistical Area (Orange County can be divided into 10 of these areas). SCAG policies also encourage job growth to be concentrated near transit services and transit nodes, and near existing freeways and toll roads. Future build-out of the Watershed, particularly residential development, would help address relevant SCAG policies regarding increased housing opportunities and job growth near transit nodes and existing freeways/toll roads.

3.5.11 Transportation/Circulation

The transportation system in the Watershed is comprised of local roads and arterials, freeways, and transportation corridors (tollroads). The Orange County Master Plan of Arterial Highways (MPAH), shown in Figure 3-17 establishes an existing and proposed countywide roadway network intended to coordinate transportation system development among local jurisdictions in Orange County. The MPAH includes a network of major thoroughfares comprising freeways, transportation corridors, and five main arterial highway classifications. The Orange County Transportation Authority (OCTA) is responsible for administering the MPAH. The main purpose of the MPAH is to describe an arterial highway system that effectively supports General Plan policies of the cities and County and is in balance with existing and adopted future land uses.

Figure 3-17. Orange County Master Plan of Arterial Highways (MPAH)

Local Roadways: Table 3-24 lists major arterial roadways throughout the Watershed and provides characteristics of the existing and proposed segments based on the MPAH.

Table 3-24. Major Arterial Roadways in Watershed

Alignment	Established Segments	Proposed Segments
Irvine Center Drive	6-lane Smart Street	None. Completed.
Irvine Boulevard/Trabuco Road	Major 6-lane divided	None. Completed.
Bake Parkway	Major 6-lane divided (southern) Primary 4- lane divided (northeastern)	Major 6-lane divided (southeastern)
Alton Parkway	Major 6-lane divided (northeastern and eastern) Primary 4- lane divided (central)	None. Completed.
Lake Forest Drive	Major 6- lane divided (southeastern) Primary 4- lane divided (northeastern)	Primary 4-lane divided (southeastern)
Ridge Route	Secondary 2-lane divided (northeastern and southeastern) Primary 4-lane divided (southeastern)	None. Completed.
Santa Maria Avenue	Secondary 2-lane divided (southern) Primary 4-lane (southeastern)	Primary 4- lane divided (southeastern)
Barranca Parkway/Muirlands Blvd.	Major 6- lane divided (western) Primary 4- lane divided (central, eastern)	None. Completed.
Portola Parkway	Major 6- lane divided (western) Primary 4- lane divided (eastern)	Primary 4-lane divided (eastern)
Jamboree Road	Major 6- lane divided	None. Completed.
Culver Drive	Major 6-lane divided (northeastern) Primary 4-lane divided (southwestern)	None. Completed.
Jeffrey Road	Major 6-lane divided (central) Primary 4-lane divided (southwestern)	Primary 4-lane divided (northeastern)

Source: Orange County Transportation Authority, Master Plan of Arterial Highways, December 2005

As shown on Figure 3-17, major east-west corridors that transect the Watershed include Irvine Center Drive, designated a six lane "Smartstreet," and Irvine Boulevard, a major arterial for its full extent within the Watershed. Alton Parkway and Barranca Parkway also provide east-west continuity, although their status varies between major and primary arterial. North-south connectivity is provided by Jamboree Road, a major arterial. Jeffrey Road/University Drive will provide a continuous north-south route throughout the Watershed once the extension of Jeffrey Road north of Portola Parkway is completed. According to the MPAH, Jeffrey Road is proposed to connect to SR-241 and continue northeasterly outside the Watershed boundary. The Jeffrey Road extension was planned concurrently with the NCCP/HCP Reserve and is an approved new use within the Watershed under the NCCP/HCP. The MPAH also shows proposed extensions of Bake Parkway, Lake Forest Drive and Santa Maria Avenue south of Irvine Center Drive. These proposed extensions are each planned to connect to Laguna Canyon Road.

Regional Transportation Facilities: Regional transportation facilities located within the Watershed but outside the jurisdiction of the OCTA or local agencies include I-5 and I-405 [owned and operated by California Department of Transportation (Caltrans)] and the Foothill (SR-241), Eastern (SR-133), and San Joaquin Hills (SR-73) Transportation Corridors (tollroads). The tollroads are owned and operated by the Transportation Corridor Agencies (TCA). Regional transportation planning emphasis in Orange County over the next 20 years will be on the completion of the widening and other improvements along I-5 and SR-91 improvements (SR-91 is located outside of the Watershed), High Occupancy Vehicle (HOV) systems, public toll roads, and privatization corridors. The focus will move to more efficient use of the existing system and includes completion of the Traffic Operations System Plan, the addition of new HOV Drop Ramps and Connectors as Express Bus service is expanded on the HOV system, and expansion of ITS technology (Corps 2001).

3.5.12 Visual Resources

The Watershed includes a variety of visual features typical to coastal southern California, including highly developed urban areas, suburban planned residential communities, highly developed to undeveloped hills, and broad alluvial and coastal plains. The inland northeastern boundary of the Watershed is defined by Loma Ridge and the Santiago Hills. The San Joaquin Hills occupy the southern central portion of the Watershed, south of I-405.

The visual character of the western portion of the Watershed reflects this area's developed nature, including developed portions of Costa Mesa, Orange, Santa Ana, Tustin, and unincorporated areas of Orange County. Views of the built environment (e.g., retail commercial buildings, multi-family and single-family housing, roads, business parks and light industrial facilities) dominate the landscape. In general, natural features within this area, such as creeks and washes, have been modified and no longer appear in their natural state. Areas where the creek channels have been lined with concrete are generally not considered scenic focal points (i.e., places that are expected or intended to draw viewers' attention).

In the developed western portion of the Watershed, the areas most resembling their natural condition include the Upper Newport Bay, located in Newport Beach, and San Joaquin freshwater marsh, upstream of Upper Newport Bay, along San Diego Creek.

The San Joaquin Hills in the southern central portion of the Watershed are experiencing continued urbanization. These hills are visible from I-405 just north of its junction with I-5 freeway. Some areas are protected under the NCCP/HCP from future development; however, large residential developments within the City of Irvine have recently been constructed or are presently under construction, south of I-405, roughly between Bake Parkway and Jeffrey Road.

Along the eastern and southeastern boundary of the Watershed, the visual character is dominated by suburban residential development in the cities of Lake Forest, Irvine, Laguna Hills and Laguna Woods. Many of the coastal hills in this area have been developed with planned residential communities. Towards the northeastern Watershed boundary, these developed areas contrast with the natural appearance of nearby undeveloped hills. The extreme northeastern portion of the Watershed is less developed and retains more of a natural appearance.

The former MCAS El Toro is one of the largest remaining underdeveloped areas along the alluvial plains that occupy the central portion of the Watershed. Large tracts of agricultural fields and patches of undeveloped hillsides also characterize the alluvial plains in the eastern portion of the Watershed. The Santiago Hills and Santa Ana Mountains are the most prominent visual features of this portion of the Watershed. The Foothill Transportation Corridor (SR-241) traverses this area and provides unobstructed views of the surrounding open space and an elevated view of the Watershed.

There are no state highways that are officially designated as “scenic” within the Watershed. According to the City of Irvine General Plan Land Use Element, Sand Canyon Avenue, Jeffrey Road, Culver Drive, SR-133 and Laguna Canyon Road are designated as roads important for “Rural or Natural Character” major views. Additionally, the proposed Millennium Parkway would be considered a scenic highway with Urban Character.

3.5.13 Water Supply and Conservation

IRWD is the primary retail water purveyor within the Watershed, encompassing a 133-square mile service area including all of the City of Irvine and portions of Tustin, Santa Ana, Orange, Costa Mesa, Lake Forest, Newport Beach and unincorporated areas of the County. Total estimated population served by IRWD is 316,000 (IRWD, 2005). Chartered by the State as a public agency in 1961, IRWD produces and distributes domestic water, collects and reclaims wastewater, and distributes reclaimed water for agricultural and urban irrigation uses, along with other uses not requiring domestic quality water. IRWD has been producing reclaimed water since 1966, and has been instrumental in advancing the use of reclaimed water into areas that have traditionally been served with domestic quality water.

Other retail water providers in the Watershed include the cities of Tustin and Santa Ana and small portions of Orange and Newport Beach. In addition, prior to its merger with IRWD in January, 2001, the Los Alisos Water District (LAWD) provided retail water service on the eastern edge of the Watershed.

Domestic Water

Domestic water served in the Watershed is a combination of water produced from local groundwater wells of the Orange County Coastal Plain Groundwater Basin and surface water imported from the Colorado River and State Water Project by the Metropolitan Water District of Southern California (MWD). MWD water is supplied to Orange County through the Municipal Water District of Orange County (MWDOC), a local MWD member agency and wholesale importer of MWD water. The Orange County Water District (OCWD) is responsible for management of the Orange County Coastal Plain Groundwater Basin.

Imported Water **-** MWD operates the Colorado River Aqueduct (CRA) that conveys water from the Colorado River to Southern California. Two additional sources of imported water are from the State Water Project (SWP) and the California Adequate. The SWP is anchored by Lake Oroville located on the Feather River north of the Sacramento/San Joaquin Delta, and the California Aqueduct, conveys water south from the delta through the Central Valley and into Southern California.

Local Groundwater- As mentioned above, OCWD is responsible for management of the Orange County Coastal Plain Groundwater Basin, which underlies roughly the northern half of the County comprising the historic floodplain of the Santa Ana River. The basin provides significant groundwater resources, and the cities and other water suppliers within OCWD presently meet up to 75 percent of their demands from basin groundwater. In 2003-04 groundwater production from the basin was 336,789 AFY (IRWD 2005). Water quality of the basin groundwater varies, but is generally superior to imported water. Water quality is the best in the northern and central areas of the basin and tends to deteriorate in areas east of the 55 Freeway and north of the I-5 Freeway. The potable groundwater supply to IRWD is produced at IRWD's Dyer Road Well Field in Santa Ana. IRWD's pumping at the Dyer Road Wellfield does not typically exceed 36,000 AFY (IRWD, 2005).

The Irvine Sub-Basin underlies the central IRWD service area and is the southeastern most extension of the Orange County Coastal Plain Groundwater Basin. The Irvine Sub-Basin encompasses the area from the base of the foothills of the Santa Ana Mountains and the San Joaquin Hills on the northeast and south, respectively, and the main Orange County Coastal Plain Groundwater Basin to the northwest. Groundwater from the Irvine Sub-Basin is generally high in total dissolved solids (TDS), color, and/or nitrates. A portion of the Sub-Basin is contaminated with TCE and other trace VOCs. Existing use of this groundwater by IRWD has been limited to supply augmentation for the reclaimed water system, primarily due to the limitation imposed by the Irvine Sub-Basin Agreement.

IRWD's Irvine Desalter Project is designed to treat and deliver 7,800 AFY of Irvine Sub-Basin groundwater to IRWD for use as both potable and nonpotable sources. The Irvine Desalter Project utilizes new wells in conjunction with IRWD's existing Well No. 78 and the TCE Well as source wells. See Section 3.4.7, Groundwater Quality for more discussion of the Irvine Desalter Project.

Water Supply Impoundments

Several water supply reservoirs exist in the Lomas de Santiago foothills as a means of impounding surface water for municipal use and agricultural irrigation. These impoundments, managed by IRWD, include: Rattlesnake, Siphon, Bonita Canyon, San Joaquin, Laguna, and Sand Canyon. Rattlesnake Reservoir, which is used for commercial, agricultural, and landscape irrigation, receives its water from surface runoff and water from Irvine Lake through the Irvine Lake Pipeline. Laguna and Siphon Reservoirs are also used to supply irrigation water. San Joaquin Reservoir is used by IRWD as a domestic water supply, and Sand Canyon Reservoir is used to store reclaimed water.

Water Demand

In 2005, water use within the IRWD service area was 79,696 AFY (IRWD, 2005). IRWD has projected an estimated total future water use of 128,725 AFY by year 2030, an increase of approximately 31 percent. Of this, approximately 70 percent is projected for the potable water system. The remaining approximately 30 percent is for the reclaimed and untreated water portions of the nonpotable water system. The conversion of agricultural land to urban uses continues with agricultural declining from approximately 60 percent of total water use in the early 1980s to approximately 11 percent in 2005 and a projected 4 percent by 2025 (build-out).

IRWD projects that in average demand years as well as multiple dry years they can produce sufficient water supplies to meet customer needs through build-out in 2025 (IRWD, 2005). To meet projected demands, IRWD is proposing a change in its water resources mix and to move from a heavy reliance on imported water to a greater utilization of local groundwater as well as expanding its water recycling through conversions, groundwater storage and groundwater treatment methods (IRWD, 2005). One of the major new local groundwater projects includes IRWD’s Irvine Desalter Project.

Water Conservation

IRWD is member of the California Urban Water Conservation Council and implements a prescribed set of urban water conservation practices (BMPs) intended to reduce long-term urban water demands (IRWD 2005). BMPs include but are not limited to customer rate structures that reward conservation and free distribution and/or installation of water saving devices.